THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. LXXXII. No. 2094.] LONDON, JUNE 30, 1903. [55TH YEAR. PRICE 6d.

PARKER & LESTER,

— *ESTABLISHED 1830* —

MANUFACTURERS AND CONTRACTORS, **ORMSIDE STREET, LONDON, S.E.**

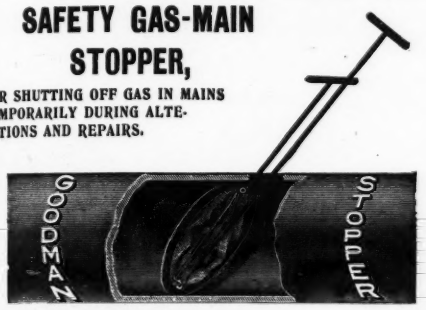
THE ONLY MAKERS OF

PATENT ANTIMONY PAINT & PARKER'S IMPERIAL BLACK VARNISH.

OXIDE PAINTS, OILS, AND GENERAL STORES, FOR GAS AND WATER WORKS.

SAFETY GAS-MAIN STOPPER,

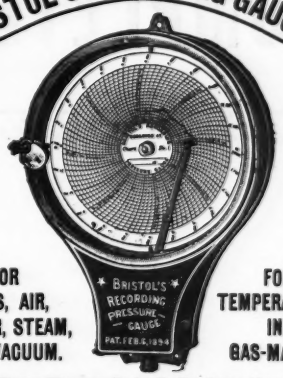
FOR SHUTTING OFF GAS IN MAINS TEMPORARILY DURING ALTERATIONS AND REPAIRS.



GAS-LEAK INDICATOR.

PRICES AND PARTICULARS ON APPLICATION.

BRISTOL'S RECORDING GAUGES



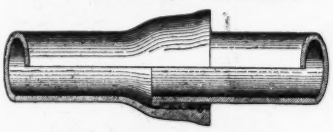
FOR GAS, AIR, WATER, STEAM, OR VACUUM.

FOR TEMPERATURE IN GAS-MAINS.

Many Thousands in Daily Operation.

J. W. & C. J. PHILLIPS,
23, COLLEGE HILL,
LONDON, E.C.

SOCKETS, WEIGHTS, & THICKNESSES



TO ENGINEER'S SPECIFICATION.

VERTICALLY CAST IRON PIPES.

Diameters 1½ in. to 78 in.

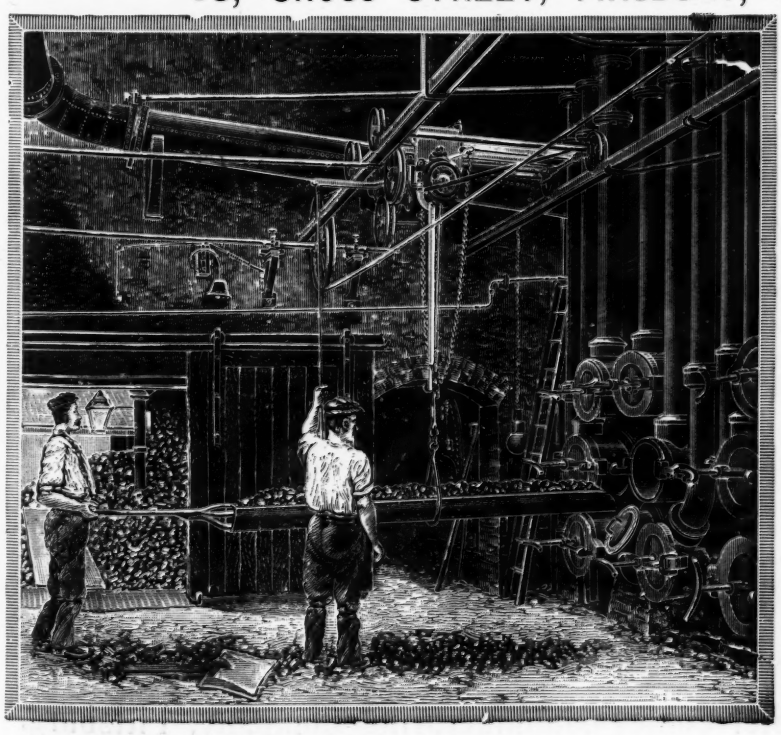
The Best Pipes on the Market and the Cheapest.

A. G. CLOAKE, 54, Holborn Viaduct, London, E.C.

Telegrams: "AMOUR, LONDON." Telephone Nos.: 1890 HOLBORN; CENTRAL 194.

BIGGS, WALL, & CO.,

13, CROSS STREET, FINSBURY, LONDON, E.C.



Telegrams: "RAGOUT, LONDON."
Telephone: 273 CENTRAL.

"RAPID"
MANUAL & POWER
CHARGING APPARATUS,

FOR GAS-WORKS OF ALL SIZES.

Repeat Orders
YEOVIL, NEWPORT, SOUTHBANK, WORTHING, ALDERSHOT.

Machines can be seen working at any of the following Works:—

ALDERSHOT	WREXHAM
WORTHING	SWINDON
YEOVIL	EPSOM
TRURO	SHETTLESTON
NORMANTON	DUBLIN
OTLEY	G. S. & W. Rly. Works
GOOLE	NEWPORT, MON.

ALBION IRON WORKS,
MILES PLATTING,

MANCHESTER.

TELEGRAMS—
"STOKER,
MANCHESTER."

WEST'S GAS IMPROVEMENT CO., LD.,

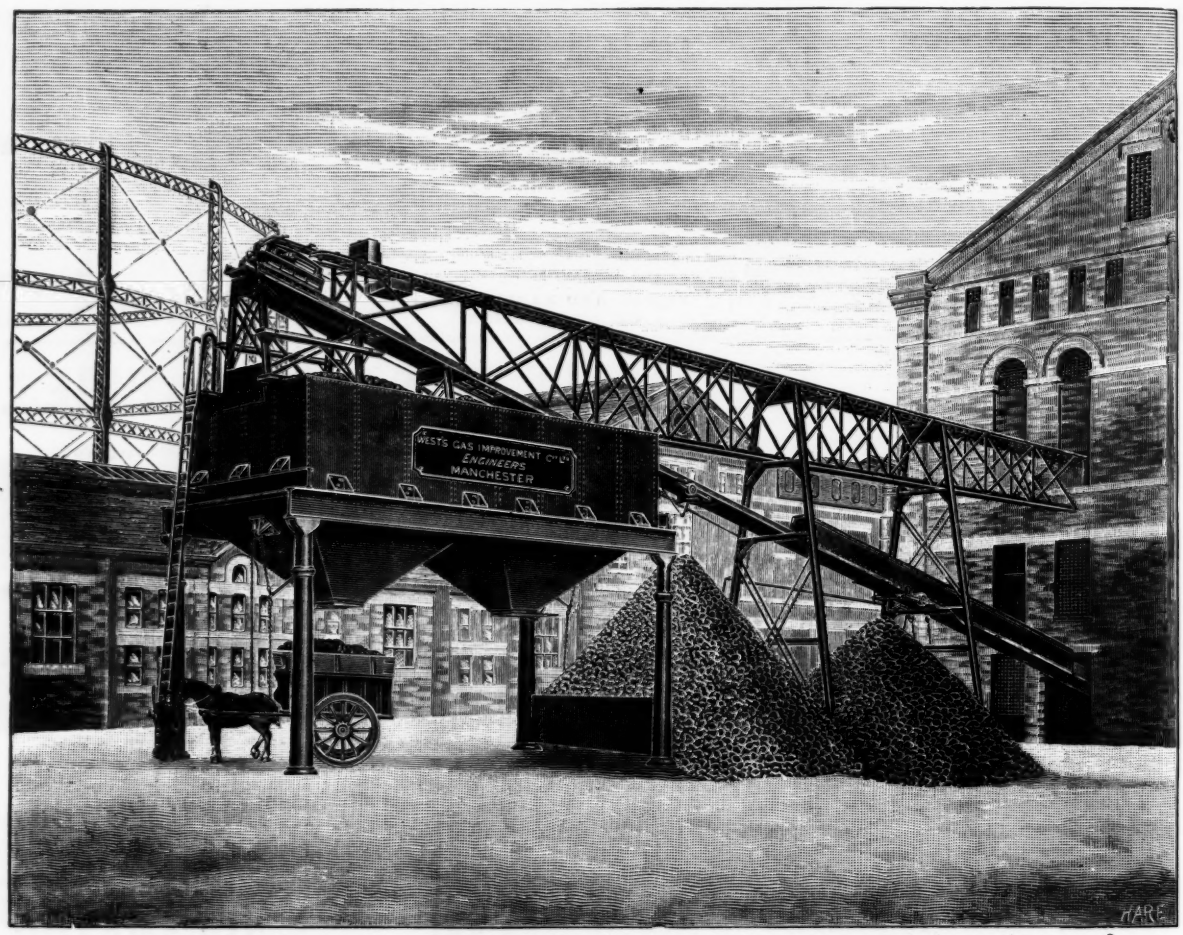
Gas and General Engineers.

CONTRACTORS FOR

COMPLETE RETORT-HOUSE PLANT

. . EITHER ON . . .

THE HORIZONTAL OR INCLINED SYSTEMS.



WEST'S CONVEYOR LEADING FROM A RETORT-HOUSE FOR STORING COKE IN HOPPERS AND COKE YARD.

WEST'S IMPROVED PATENT HOT-COKE CONVEYOR,

With Special Chain constructed with a minimum number of parts, and having Large Joint Pins with ample Bearing Surfaces.

WEST'S STOKING MACHINERY— COMPRESSED AIR DRIVEN AND MANUAL SYSTEMS.

COAL BREAKING, ELEVATING, & STORING PLANTS.

BELTON'S PATENT AUTOMATIC RELIEF APPARATUS FOR HYDRAULIC MAINS.

Manufacturers for America : Riter-Conley Manufacturing Company, Pittsburg.

THE BARROWFIELD IRON-WORKS, LTD.,

GAS ENGINEERS AND CONTRACTORS

Telegrams:
"GASOMETER GLASGOW."

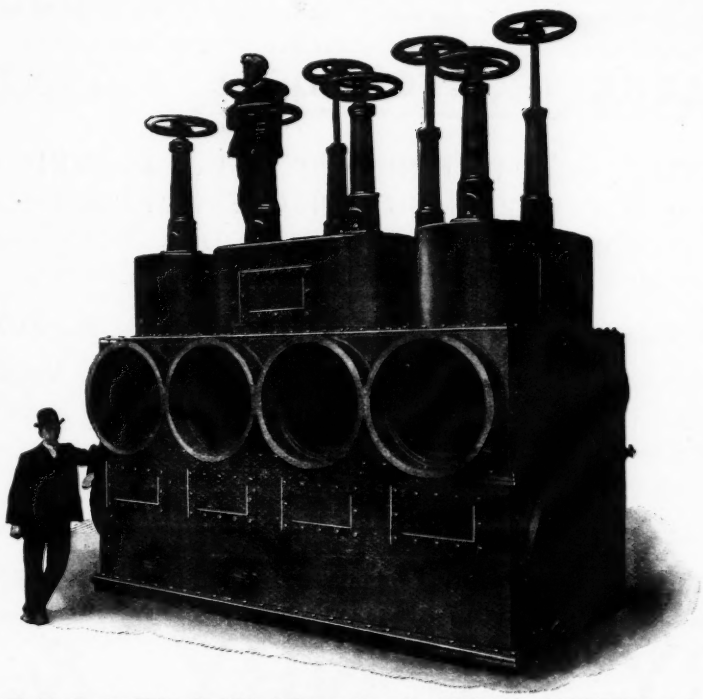
OIL PLANT AND CHEMICAL APPARATUS.

BRIDGES, GIRDERS, WHARVES, PIERS.

ROOFING OF EVERY STYLE.

PIPES, VALVES, AND CONNECTIONS.

London Office:
6, LITTLE BUSH LANE, CANNON STREET, E.C.



Weck's Centre-Valve for 30-inch Connections for GRANTON GAS-WORKS of the EDINBURGH and LEITH CORPORATIONS GAS COMMISSIONERS.

GLASGOW.

GAS APPARATUS OF EVERY DESCRIPTION

RETORTS, CONDENSERS, SCRUBBERS, PURIFIERS.

GASHOLDERS AND TANKS.

ENGINES, EXHAUSTERS, STEAM-BOILERS AND FITTINGS.

GEORGE ORME & CO. (Branch of Meters Ltd.)

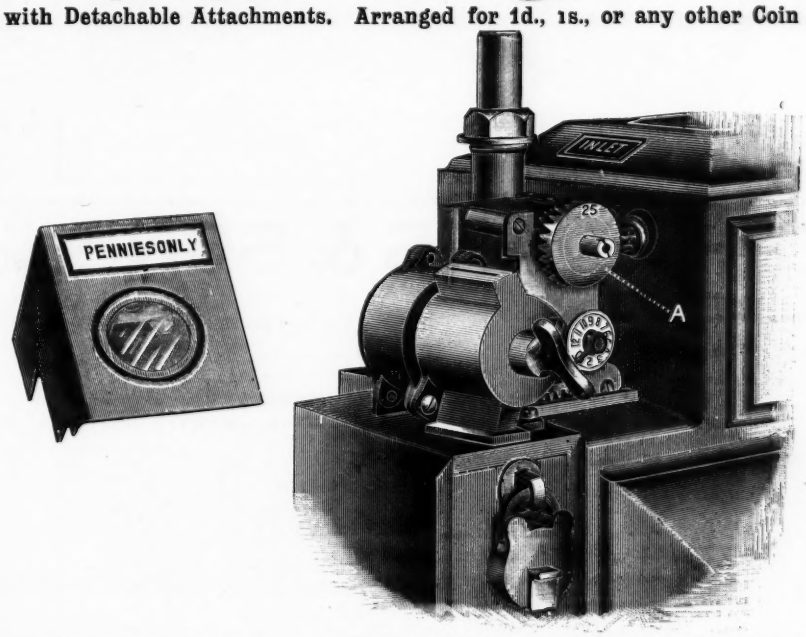
Atlas Meter Works, PARK STREET, OLDHAM.

Telegraphic Address: "ORME, OLDHAM." Telephone No. 93 OLDHAM.

"NEW CENTURY" PATTERN

Patent Coin *Prepayment Gas-Meters*

Fitted with Detachable Attachments. Arranged for 1d., 1s., or any other Coin desired.



CHANGE OF PRICE EFFECTED BY SIMPLY REMOVING CROWN WHEEL "A" AND REPLACING SAME WITH ANOTHER WHEELS.

NEWTON, CHAMBERS, & CO.,

LIMITED,

THORNCLIFFE IRON-WORKS, NEAR SHEFFIELD.

Established 1790

LONDON OFFICE: 19, Great George Street, WESTMINSTER.

Telegraphic Addresses: "NEWTON, SHEFFIELD," "ACCOLADE, LONDON."

GAS ENGINEERS IRONFOUNDERS & CONTRACTORS.

MANUFACTURERS OF EVERY DESCRIPTION OF

PLANT, APPARATUS, AND MACHINERY FOR GAS AND CHEMICAL WORKS, RETORTS AND FITTINGS, MOUTHPIECES WITH SELF-SEALING LIDS. IMPROVED COAL AND COKE HANDLING PLANT, CONVEYORS AND ELEVATORS, CONDENSERS, SCRUBBERS AND WASHERS.

PURIFIERS with Planed Joints a Speciality.

PATENT CENTRE-VALVES, RACK AND SCREW VALVES, WOOD GRIDS, AND SCRUBBER-BOARDS, CAST-IRON MAINS, AND SPECIALS. STRUCTURAL WORK, COLUMNS, GIRDERS, AND ROOFING. GASHOLDERS CAST-IRON OR STEEL TANKS.

DESIGNS, SPECIFICATIONS, and ESTIMATES FREE.

PIG IRON (SPECIAL QUALITY) for Engine Cylinders. GAS COAL famous for its unrivalled excellence.

BARRY, HENRY, & CO.,

— LIMITED. —

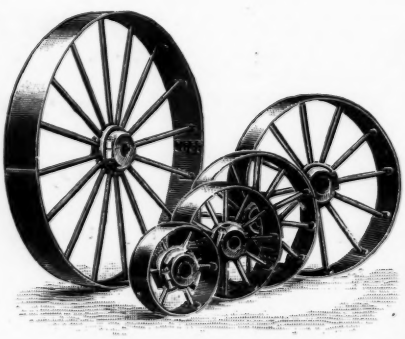
Specialities:

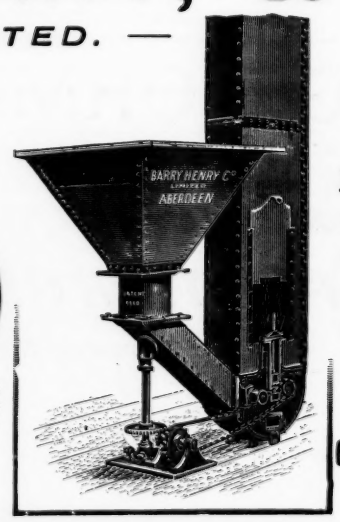
TRANSMISSION OF POWER.

Rope & Belt Pulleys,
Spur & Bevel Wheels,
Shafting & Couplings,
Pedestals. & Fixings.

WORKS:

ABERDEEN
SCOTLAND.





Specialities

TRANSMISSION OF MATERIALS.

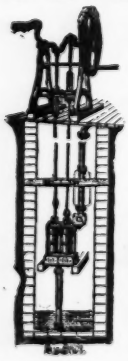
Conveyors
Elevators,
Grinding Machinery,
Motors.

AND

64, MARK LANE,
LONDON, E.C.

JOSEPH EVANS & SONS,

CULWELL WORKS, WOLVERHAMPTON.

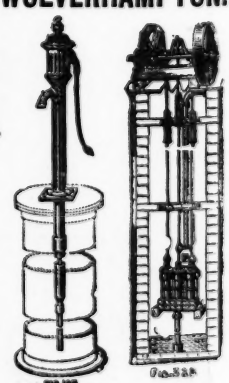


London Address:
Salisbury House, London Wall, London, E.C.

PLEASE APPLY FOR CATALOGUE No. 8.

TRADE MARK.
FIRST AWARDS EVERYWHERE.

Telegrams:
"EVANS, WOLVERHAMPTON."
National Telephone No. 7089.



See next Week's Advertisement for Steam-Pumps, Tar and Liquor Pumps, &c.

HISLOP'S PATENT RETORT SETTINGS

THE RESULTS GUARANTEED ARE CERTIFIED
TO EXCEED THOSE OF ANY OTHER SYSTEM.

R. & G HISLOP,
Gas Engineers and Contractors,
13, ST. JAMES PLACE,
PAISLEY.

"DURA" "DURA"

INCANDESCENT GAS MANTLE

SECOND TO NONE.

Unexcelled.

The "**DURA**" Mantle is now made of the best 3-ply **Ramie** of English Manufacture.

The "**DURA**" Mantle is of **English** Manufacture throughout.

The "**DURA**" Mantle is sold to Plumbers, Gas-Fitters, and Retail Ironmongers through the usual Wholesale Houses.

Unshrinkable.

The "**DURA**" Mantle is Manufactured and sold under License.

The "**DURA**" Mantle is made in all sizes.

The Company continue to make the original "**DURA**" Mantle.

The new "DURA" Ramie Mantle is the best for Street-Lighting, and is therefore recommended to Gas Managers.

The Guaranty Incandescent Mantle Co., Ltd.,
Phœnix Works, STREATHAM, LONDON, S.W.

"DURA" "DURA"

D. HULETT & CO., LTD.

Show-rooms and Offices: 55 & 56, HIGH HOLBORN, LONDON.

Lamp & Meter Works: HARPUR MEWS, THEOBALD'S RD, LONDON.

MANUFACTURERS OF

OUTSIDE GAS-LAMPS

Suitable for Incandescent or Ordinary Burners.

DRY GAS-METERS, SERVICE-CLEANSERS, &c., &c.

PRICE LISTS ON APPLICATION.

COLLIERY EXHIBITION,

AGRICULTURAL HALL, ISLINGTON, N.

JUNE 30TH TO JULY 7TH, INCLUSIVE.

ENGINEERS and others interested in utilization of Refuse Fuels, should pay a visit to **Stand No. Row 3, Block No. 17**, where Special Furnace may be seen.

Complimentary Tickets will be sent to interested parties.

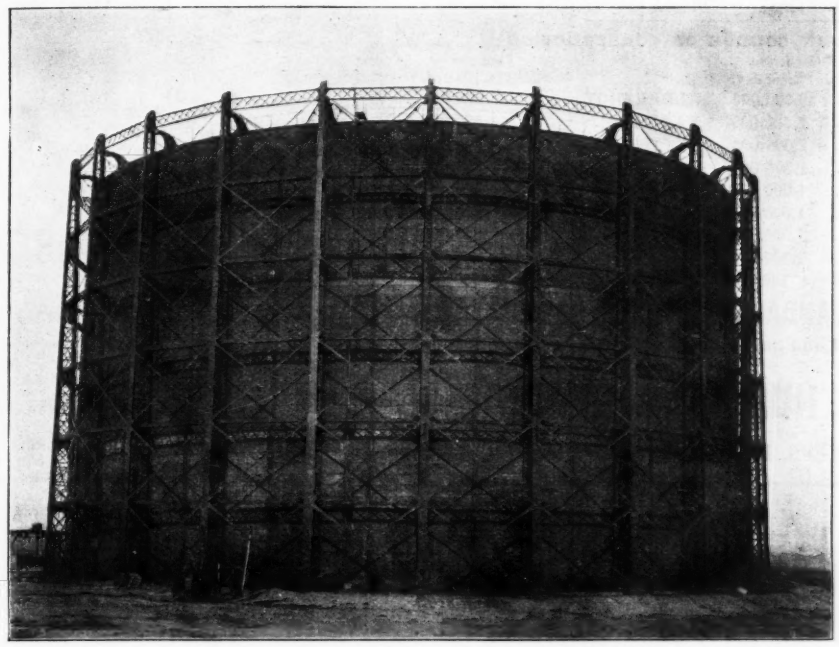
MELDRUM BROS., LTD., TIMPERLEY, MANCHESTER

And at 66, VICTORIA ST., WESTMINSTER, S.W.

THE WHESSOE FOUNDRY CO., LTD.

Works: DARLINGTON.

MAKERS OF EVERY DESCRIPTION OF GAS PLANT.



GASHOLDERS AND DRY-SEAL PURIFIERS A SPECIALITY.

NEWCASTLE AND GATESHEAD GAS CO
DIA. 236 FT. HEIGHT 133 FT.

THREE-LIFT GASHOLDER.
CAPACITY 6 MILLION CUB. FT.

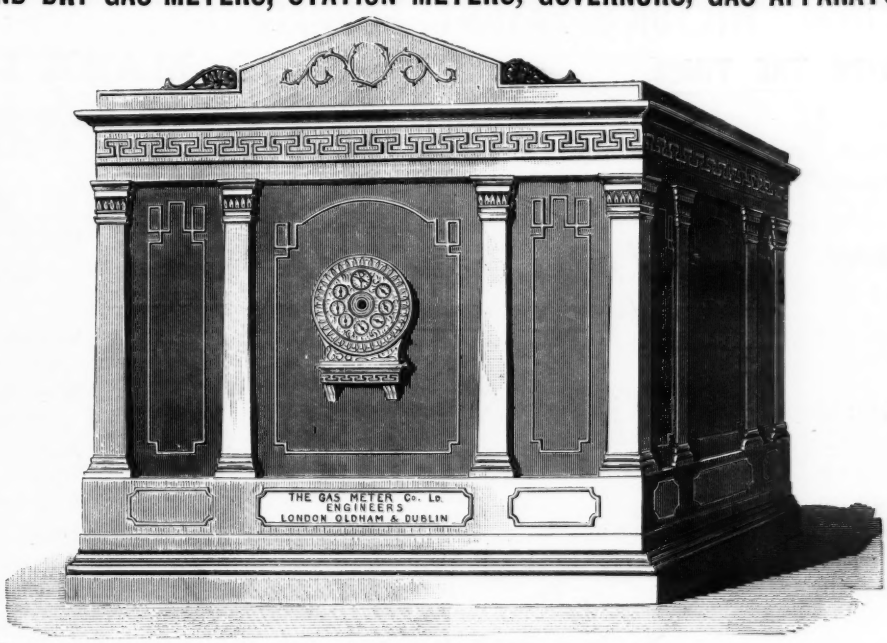
London Office: 106, CANNON STREET, E.C.

THE GAS-METER COMPANY,

MANUFACTURERS OF

WET AND DRY GAS-METERS, STATION METERS, GOVERNORS, GAS APPARATUS, ETC.

SQUARE STATION METERS WITH PLANED JOINTS.



STATION METERS IN CYLINDRICAL CASES.

DESIGN No. 2 PATTERN.

STATION METERS MADE AT THE COMPANY'S WORKS, OLDHAM (LATE WEST & GREGSON). Established 1830;

For Prices and Particulars apply to

F. W. CHURCH, Secretary.

Works: 238, KINGSLAND ROAD, LONDON; UNION STREET, OLDHAM; HANOVER STREET, DUBLIN.

Telegraphic Address: "METER."

See Advertisement on back of Wrapper.

PATENT

"STANDARD" CONDENSERS

ADVANTAGES:—

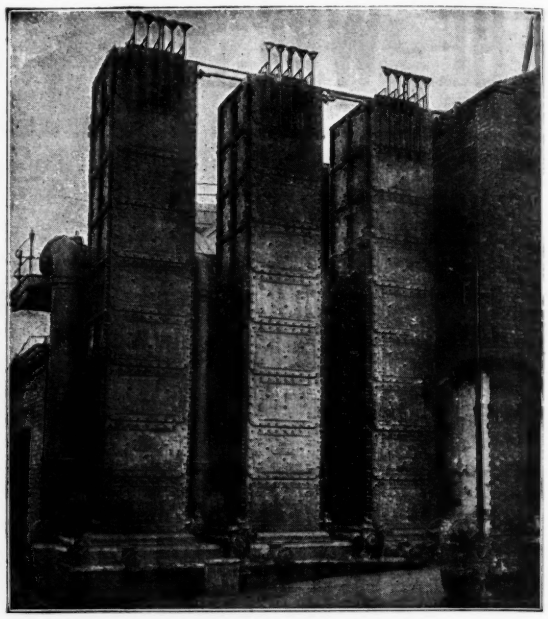
Slow Speed. Large Area for Gas and Water.
Easy access to Interior. Capacity easily increased, &c.

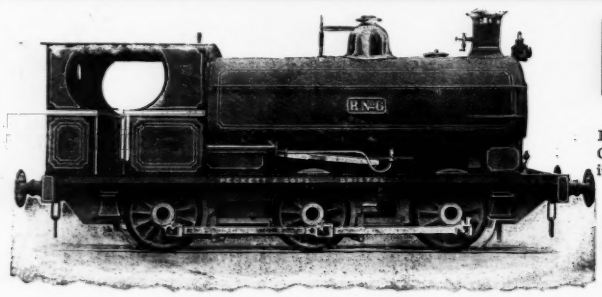
IN USE OR IN COURSE OF CONSTRUCTION:—

	Capacity Cub. Ft. per day.		Capacity Cub. Ft. per day.
GLASGOW . .	12,000,000	ALDERSHOT . .	500,000
ANTWERP . .	2,500,000	RANDERS . . .	500,000
COVENTRY . .	2,000,000	CETTE . . .	400,000
COPENHAGEN .	1,500,000	BARKING . . .	300,000
BURY . . .	1,000,000	PINNER . . .	250,000
SUTTON . . .	1,000,000	HERNE BAY . .	250,000
GLOUCESTER. .	1,000,000	PELTON COLLIERY.	250,000
SCARBOROUGH .	1,000,000	TUBORG . . .	250,000
GUERNSEY . .	750,000	AALBORG . . .	250,000

PATENT "STANDARD" WASHER-SCRUBBERS,
See last and next week's Advertisements.

KIRKHAM, HULETT, & CHANDLER,
LIMITED
PALACE CHAMBERS, BRIDGE ST., WESTMINSTER, S.W.





LOCOMOTIVES

LOCOMOTIVES of all Sizes and Gauges specially constructed for Main and Branch Lines, Contractors, Docks, Gas-Works, Collieries, Iron-Works, Brick and Cement Works, &c. Locomotives of various Sizes always in Stock, ready for immediate Delivery.

Photographs, Specifications, and Prices on Application.

PECKETT & SONS, Atlas Locomotive Works, **BRISTOL.**

Telegraphic Address: "PECKETT, BRISTOL."

THE CHEMICAL ENGINEERING CO.

Telephone: No. 2669 AVENUE.
Telegrams: "EVAPORATOR, LONDON."

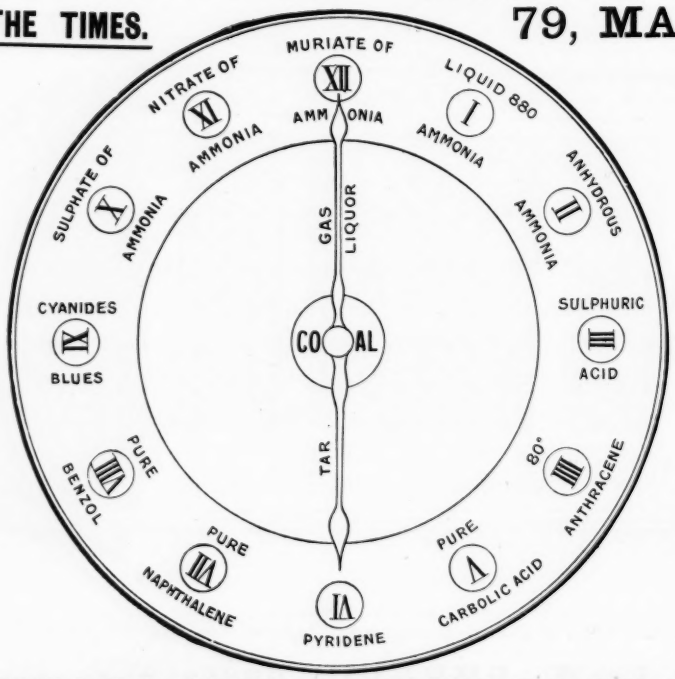
AND

WILTON'S PATENT FURNACE CO.,

CROWN WORKS, ABBEY LANE, STRATFORD, E.

KEEP UP WITH THE TIMES.

79, MARK LANE, E.C.



Contractors for Erection of TAR AND AMMONIA WORKS.

The make of Sulphate of Ammonia from the first round Saturator constructed, has exceeded 40,000 Tons, and the repairs have been practically *nil*.

Can be seen working by appointment.

WILTON'S PATENT SATURATOR AND DISCHARGER

IN USE AT:

Gaslight and Coke Company's Works, Beckton
South Metropolitan Gas Company.
Manchester Corporation Gas-Works.
Burt, Boulton, & Haywood.
Margate Gas-Works.
Longport ,, ,,
Douglas ,, ,,
Worthing ,, ,,
&c.

CONVEYORS and ELEVATORS SPECIALLY DESIGNED FOR THE ABOVE PRODUCTS.

Wilton's Patent Neutralizing Apparatus for the Waste Gases from Sulphate of Ammonia Plant.

CONTENTS.

EDITORIAL NOTES.

GAS, LIGHTING, &c.—
The Maintenance of Gas Plant 939
Mr. Brackenbury on the New Coal Projectors 939
The Zurich International Photometry Conference. 940
Report of the Chief Inspector under the Alkali Works Acts 940
The Coal Duty, and the Incidence of Taxation 941
The Latest Disaster to the New Unionism 941
The Bermondsey Clause—Profits for the Consumers — Municipal Trading in General—And Birmingham Gas in Particular — Vitality at Plymouth — Some Suggestions — Engineering Training — Begging for the Holidays 942

ESSAYS AND REVIEWS.

Gas and Water Stock Market 945
Electric Lighting Memoranda 945
The Granton Works of the Edinburgh and Leith Gas Commissioners. 946
Manual of Electrical Undertakings for 1903 . 948
The Engineering Conference: Questions of Gas Engineering 948
Analyses of Ammoniacal Liquors 949
From Siding to Coke-Store at the Bury Gas-Works. 951
The International Committee on Photometry 957

COMMUNICATED ARTICLES.

New Machines for Old. By C. E. Brackenbury 961
The Bermondsey Clause and Municipal Trading. By Vincent R. Balfour-Browne, B.A. 963
Fans in Gas-Works. By R. Gordon Mackay 964

CORRESPONDENCE.

The Fiscal Problem and the Coke Trade . . 971

TECHNICAL RECORD.

The German Association of Gas and Water Engineers — Annual General Meeting at Zurich. 966
Manchester and District Junior Gas Association—Visit to Wilmslow 967
The Utilization of Gas-Works Clinker and Gas Lime 968
A Serviceable and Readily Disjointed Incandescent Burner 968
The Claus Sulphur-Recovery Process at Granton 969

REGISTER OF PATENTS.

Gas-Engines—Rowbotham, W. & K. A. . . 971
Self-Igniter for Gas-Burners—Parizot, F. C. N. 971
Gas Washing and Scrubbing Revolving Surfaces—Kirkham, H., and Chandler, S. A., 971
Wet Gas-Meters—Alexander, W. 971
Incandescent Gas-Burners — Wise, W. L. (Bruno, Schömann, and Co.) 971
Gas-Lamps—Webb, J. E. 971
Gas or Air Compressors or Pumps—Keith, J. & G. 971
Bye-Pass Cock for Incandescent Gas-Burners —Keith, J. & G. 972
Inverted Incandescent Gas-Burners—Hellmann, H. W. 972
Patent Notices 972

PARLIAMENTARY INTELLIGENCE.

Gleanings from the Committee Rooms . . 972
Progress of Bills 973
Sheffield and the Derwent Valley Water Scheme 973
The Supply of Water to the Aldershot Camps 973

LEGAL INTELLIGENCE.

Court of Session—The New Conveyor Company and their Patent 973

MISCELLANEOUS NEWS.

Plymouth and Stonehouse Gas Company. . 974
Report of the Chief Inspector under the Alkali Acts 975
Next Year's Examinations in Gas Manufacture 976
Stock and Share List 976
Further Installations of the Keith Light . . 977
Electric Lighting Notes 977
Chelsea Water-Works Company 979
Carlisle Water Supply—The Geltsdale Scheme to be Carried Out 979
Current Sales of Gas Products 980
Notes from Scotland 981
Coal Trade Reports 983

PARAGRAPHS.

The Present and Future of the Hastings Gas-Works—Spiral-Guided Gasholder at Romford 944
Carburetted Air for Lighting and other Purposes 945
Incandescent Gas Lighting for Churches . . 950
A Water-Tower Coke-Quencher 956
Personal and Obituary 961
Society of Arts—The King's Birthday Honours 967
Examinations in Gas Manufacture. . . . 983
A Satisfactory Report at Selby—Leeds Gas Supply — Reductions in Price — Bruce Peebles and Co., Limited—Metropolitan Water Board—Irish Gas-Works and Meter Stamping—Serious Gas Explosion at Barnard Castle—Completion of the Midhope Reservoir at Barnsley 984
Profits at Oldham—Higham Ferrers and Rushden Water Board—Loans of Local Authorities — A Much-Needed Filtration Scheme—The Rainfall in May and the London Water Supply—Sale of Stock of the Croydon Gas Company 985

Messrs. HUMPHREYS & GLASGOW

AND

THE UNITED GAS IMPROVEMENT CO., U.S.A.

CARBURETTED WATER-GAS PLANT

— *DOUBLE SUPERHEATER SYSTEM.* —

H. & G., LONDON **135,450,000** Cu. Ft. Daily

U. G. I. CO., U.S.A. **369,200,000** Cu. Ft. Daily

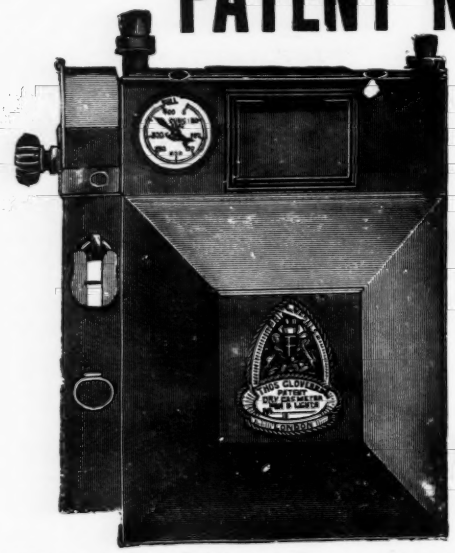
TOTAL 504,650,000 Cu. Ft. Daily

Messrs. HUMPHREYS & GLASGOW,
38, Victoria Street, London, S.W.
31, Nassau Street, New York.

THE UNITED GAS IMPROVEMENT COMPANY,
Philadelphia.

Telegrams: {"EPISTOLARY, LONDON."
{"HUMGLAS. NEW YORK."

THOMAS GLOVER & CO.'S PATENT NEW IMPROVED PREPAYMENT METER



For Pennies, Shillings, or any Coin.

Simple in Mechanism.
Positive in Results.
Price Changer *in Situ.*

GUARANTEED FOR FIVE YEARS.

Telegraphic Address: "GOTHIC, LONDON." Telephone No. 725, Holborn.

THOMAS GLOVER & CO., LTD.,
DRY GAS-METER MANUFACTURERS,
214 TO 222, ST. JOHN STREET, CLERKENWELL GREEN, LONDON, E.C.
Telegraphic Address: "GOTHIC, LONDON. Telephone No. 725 Holborn.

BRISTOL: 28, BATH STREET. *Telegraphic Address: "GOTHIC."* Telephone No. 1005.

BIRMINGHAM: 57 & 58, BROAD STREET, *Telegraphic Address: "GOTHIC."*

MANCHESTER: 132 & 134, CORN EXCHANGE BUILDINGS. *Telegraphic Address: "GOTHIC."* Telephone No. 3898.

GLASGOW: 26, WEST NILE STREET. *Telegraphic Address: "GASMAIN"* Telephone No.: 6107 Royal.

PARKINSON AND W. & B. COWAN, LTD.,
(*Parkinson Branch*)
COTTAGE LANE, CITY ROAD, LONDON. | BELL BARN ROAD, BIRMINGHAM.

PARKINSON'S STATION METERS

OF

ORNAMENTAL DESIGN

AND

STRONG CONSTRUCTION.

OVER **1000** OF OUR STATION METERS HAVE BEEN ERECTED.

JOURNAL OF GAS LIGHTING, WATER SUPPLY, &c.

EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. LXXXII., No. 2094.—TUESDAY, JUNE 30, 1903.

EDITORIAL NOTES.

The Maintenance of Gas Plant.

OPINIONS apparently still differ as to the correct rule for dealing with the element of depreciation, as part of the working expenses of a business. Light was thrown upon the subject in the course of the recent meeting of the Institution of Gas Engineers, both in Mr. A. Valon's useful paper and in the subsequent discussion. If one of the contributions may be chosen for special attention, it must be that of Mr. R. O. Paterson, who, taking him all round, is one of the safest of living guides in practical gas managership. Without attempting to add to or take from what was placed upon record on this occasion, it occurs to us that some of those—electricians and others—who are still wandering in the outer darkness of ignorance, wilful or other, of what is meant by the "maintenance" of an undertaking, would do well to put themselves in the place of an ordinary contractor for public works. We do not hope much for the conversion of those who will not receive instruction, perhaps because they are afraid to have their eyes opened to the truth. Mr. Horace Boot, for instance, the Tunbridge Wells electrician, tried to be "smart" at our expense a fortnight ago; but he only succeeded in exhibiting his incapacity, which it is difficult to believe is real, to distinguish between the repair of plant and the making of it good when worn out. Yes, gas managers keep all their buildings, plant, works, and machinery in perfect repair, as a revenue charge; but they do not believe that at the end of every year the material things so treated are "as good as new." Mr. Boot declares that this is true of electricity generating and distributing plant, which must therefore differ from gas plant in possessing the gift of perpetual youth. And, in addition to repairing his plant, the gas manager makes provision for its restoration.

If it never grew old or worn out, doubtless such provision as this would be superfluous. As a matter of fact, there is something about a gas undertaking which does not deteriorate; and that is the realizable value of the investment. Consequently, this asset is not redeemed out of working expenses. All the perishable, material assets on which the capital has been spent, however, are "main-"tained," as well as kept in repair, out of revenue. Now, this maintenance is a purely financial operation. It is physically impossible to keep the gasholders from growing old; and we think they should earn their own replacement while they are yet in service. Not that (as Mr. Paterson said) it is always necessary to restore an old gasholder with a replica. Its renewal is realized in the form of the cash equivalent; and if its re-embodiment will do more good to the organization of which it was a member in some other shape, this is nothing to do with the process that has been carried out. A retort-house, a gasholder, a boiler will fulfil its purpose for all its economic lifetime, after which it is removed; but the money for replacing it is ready, and so long as this goes into the assets again somehow, that is proper. Neither of the funds mentioned by Mr. Boot, nor one which he did not name—the insurance fund—is properly chargeable with this restoration. Still less is fresh capital properly spent in providing a piece of plant which does not add to the earning capacity of the whole. If the cost of a second boiler is to be added to that of its predecessor, this means doubling the capital investment to no advantage; and that way lies the Bankruptcy Court.

The contractor for public works has a short and easy way of formulating his rule in such matters. With all the straightforwardness of the "navvy" with whom he has such intimate relations, the contractor remarks: "It is a poor "job that does not pay for the plant." Exactly; and though gas-works run on for years, whereas a contract for the construction of a tank endures but for a season, the rule of solvent liquidation of the plant used, and worn out, is the same for both. Is the point clearer now? One would fain hope so; but there are none so dull as those who will not learn. We have contrived to write this "Note" throughout without using the word "depreciation," because it is so hackneyed. Besides, it is a word which needs to be understood in this connection in a technical sense; and technical meanings are always fruitful sources of misunderstanding between people who are not shopmates. Also, curiously enough, when "depreciation" is mentioned by works managers, what they are really thinking of is the reciprocal "restoration." Like helmsman's language, it goes by contraries. Really, depreciation is the physical process by which the moments of every dead thing hasten to their end. The infinite scrap-heap lies in wait for all; and though, as Hamlet said upon a certain *memento mori*, one paint and patch an inch thick, "to this complexion "we must come." Maintenance is the financial provision for inanimate plant which corresponds to life assurance. If that is not a proper charge upon revenue, what is?

Mr. Brackenbury on the New Coal Projectors.

IN matters affecting gas-works construction, Mr. C. E. Brackenbury is a capable critic; and his article, which appears in another part of this issue, on the new coal projectors for retort charging and the ram for retort discharging is certain to be read with interest. We are glad to have this account of his impressions, because it is only—before practical trials have been made of such innovations as these under varying conditions of working—by giving due consideration to the best and worst that can be said of them, together with all the intermediate argument, that anything approaching a settled opinion can be formed as to their general applicability. In regard to these machines, we are, of course, owing to their necessarily limited use, in a somewhat indefinite position at the present time. It will therefore be well for readers of the article communicated by Mr. Brackenbury to remember that it is simply a record, in large measure, of his personal impressions, and that those impressions are subject to the proof or disproof of actual experience. At the same time, with his varied experience, there is not one of them that can be lightly brushed aside. Other gas engineers, however, have witnessed the machines in operation, have been favourably impressed, and more than one, it is understood, are making arrangements to put those impressions to the test in ordinary working in this country.

Mr. Brackenbury starts his article by announcing that he does not desire to err either on the side of optimism or pessimism; and he ends up with the cheerful optimistic shout "The foundations of inclined retorts remain unshaken." This lively critic is an ardent inclined retort man—where conditions are suitable; and it is men of such zealous view who form the keenest of critics of an opposing system. From their opinions, a fair discount can always be allowed for prejudice. In this instance, the article bears evidence of the writer having striven hard not to permit the public statement of his present judgment to be blurred by the strength of his old attachment; and, taken throughout, the criticism of the new machines must be pronounced as fair, if not of sufficient strength to carry conviction home in every respect. We hope that the article will incite other readers who have inspected the working of one or both of the machines to relate their impressions, so as to get as broad a discussion as possible. There are points which invite comment here; but it is preferable to leave them, if readers feel disposed, to free discussion. However, two general points which have a relation may be touched upon. Mr. Marshall's figures may be tinctured by his enthusiasm, and may admit of contest. But we can find nothing odd, or anything to gibe at, in a man's views changing in five years, with the advent in the meantime of new principles and methods. Five years is a long period in the history of an industry. Glancing backward, we are not alone in knowing the views of eminent gas engineers to change in a shorter period than that, from shovel to scoop charging and on to machine work; in a shorter period, too, direct-fired settings have been known to give place to regenerative settings; and, again, men who have contemptuously described inclined

retorts as "slopers," and said all manner of ill things against them, have also changed their views within a shorter space of time. Examples, if necessary, could be multiplied. The new machines are not the old, well-established machines; they possess differences all-sufficient for promoting a change of view. If all gas engineers had been long and profoundly impressed during the last quarter of a century by the magician's cry of "Old Lamps for New," progress in the gas industry—both on its manufacturing and commercial sides—would indeed have been slow. How long did Mr. Frank Morris remember that cry after he had seen the inclined retorts at work at Rheims? How long did Mr. Brackenbury remember it after he had first witnessed the working of an inclined retort bench?

However, the inventors and makers of the new machines will find consolation in the fact that, though "the foundations "of inclined retorts remain unshaken," Mr. Brackenbury "recognizes in both machines," even with the ink of his criticism still wet, "new servants to be used for the benefit "of the gas industry and the community." We are glad he has written, and written, as is his wont, fairly and straightly; and perhaps one effect will be to hasten the time when we shall have before us the results of a trial of the machines in every-day work in this country. Meanwhile service would be rendered through discussion by those who have witnessed the performances of the machines and considered their possibilities in any way in the reformation of retort-house method and equipment and saving (if any) in installation and working expenses. There can be discussion without branding oneself as entertaining the sanguine view that the new machines are going to suddenly revolutionize all existing retort-house practice.

The Zurich International Photometry Conference.

Much interest attaches to the proceedings of the International Conference on matters of photometry just concluded at Zurich, and in course of being specially reported in the "Journal." A contribution of great importance is that of Dr. H. Bunte, of which we give a full translation this week. This deals with the relative values of the various standards of light employed in the technical work of all nations, and constitutes an invaluable starting-point for further work in the interest of standardization. It has been agreed that comparative photometric testings shall be carried on independently in Germany, England, and France, with the view of verifying the data provisionally ascertained by Dr. Bunte; and it is very interesting to note that a strong plea for the English standard candle was entered by Professor Vivian B. Lewes, who is by no means prepared to relinquish this simple and historic unit. After all, British and American technicians "think in candles;" and it is not to be supposed that they will easily cease to do so, whatever the working equivalent of the actual candle they may prefer to use for the mere sake of convenience. Nothing was said at the conference about the Methven standard, although it is very generally used—especially, we believe, in the United States.

It is rather a pity, by the way, that America is left out of this Committee. Though it is a satisfactory arrangement that the work of standardization should be carried on by the three countries, it is not altogether gratifying that the reference to England should be, as one may say, without any precise address. We cannot agree that either the Metropolitan Gas Referees or the Institution of Gas Engineers would be the proper English authority to deal with this matter. They both lack the recommendation of universality. How was it that nobody at Zurich remembered the National Physical Laboratory? The worst of this national reference is that each nation will be more confirmed than ever in the preference for its own standard. Dr. Bunte, like a good German, stood up for the Hefner standard, which leaves a great deal to be desired. It throws upon the photometer and the observer an undue share of responsibility for the attainment of really accurate measurement of the more powerful artificial lights. One can scarcely imagine that if the intense lights of the present day had been in question when the Germans were seeking for a standard of their own, they would have condescended upon a unit of this style and value. No working photometrist would exchange the Harcourt 10-candle unit for it, if only on account of the superior power of the former. It is true, of course, as Professor Lewes remarked, that the Harcourt ten-candle standard exists only by prescription of the London Gas Referees. But it is about the best thing this body ever did for photometry; and its use outside penalty gas testing in the Metropolis is increasing.

Some relics of the long past and gone were unearthed by Dr. Bunte in the table accompanying his paper. One from the pages of the "Journal" as far back as 1869 forms interesting reading even after this long lapse of time. It was prepared in connection with the Paris Exhibition of 1867, was recorded in the "Journal" for Feb. 2 two years later, and was really a very remarkable piece of work. It opened with a determination of the relative illuminating powers of the London and Paris standards of light. At that time the French carcel lamp was the standard, as it is still, and it was used in the same way. The English standard was the sperm candle; the gas being burnt in the standard argand burner at the rate of 5 cubic feet per hour. The reporters thought the French the better system. They ascertained the illuminating power of Paris gas, by means of the English candle standard and the "London" argand "for 12-candle gas," burning the gas at the rate of 5 cubic feet per hour, to average 12¾ candles. This "London" argand was lent for the purpose by Mr. G. Glover, of Pimlico. The particulars of the burner are not given; but it is described as being used "for testing gas in "London." One of the matters to which the reporters had directed their attention was the question of the advantage of carburetting this common Paris gas (it was supposed to be about the same quality as London gas) with naphtha. The results showed that the advantage was rather on the side of using a larger quantity of the uncarburetted gas to give the additional light, instead of gaining the increase of light by carburetting at the burner. "Scholl's perfecters"—a device of platinum plates inserted in a flat-flame burner with the object of increasing the light—were a craze of that day. The report demolishes their character. Paraffin-oil lamps were also tested; the oil being priced at 2s. 6d. per gallon. What times for the trade! Young's lamp and oil far surpassed all others. Yet gas, at 4s. per 1000 cubic feet, beat it easily, even with the batswing and fishtail burners. The most interesting feature of this report is its perfect candour and simplicity. The same number of the "Journal" contains a lecture by Dr. Odling, who is happily still with us and of the same mind, against the exaggeration of popular complaints of the bad effects of the combustion of gas for lighting interiors. Thirty-four years were to pass before Parliament could at last be brought to see eye to eye with Dr. Odling on this matter; and the striking thing is that the veteran should have been preserved to help win, in 1903, a battle in which he was striking doughty blows in 1869.

The Report of the Chief Inspector under the Alkali Works Acts.

The Thirty-ninth Annual Report of the Chief Inspector under the Alkali, &c., Works Regulation Acts, has been issued, as was briefly announced last week, and copious extracts therefrom appear in other portions of the present issue. It is always a pleasure to welcome the appearance of Mr. R. Forbes Carpenter, and his able assistants, with these yearly accounts of their official proceedings. The reason is that these estimable gentlemen and good servants of the State have always known how to do their duty without assuming, as a necessary preliminary, that the followers of the industries over which they are required to watch are rogues and cheats. They would not satisfy the London County Council. There were no prosecutions for the year! The fact, however, which has often been recognized, that the Inspectors under the Alkali Acts interpret their duty to be that of helping chemical manufacturers to obey the law, instead of trying to catch them in traps of ingenious device, differentiates them from almost all other official inspectors ever heard of. They even go so far as to acknowledge that manufacturers and their heads of departments have always been willing and anxious to help them in the discharge of their duties. Mr. Carpenter evidently does not know that "Sunday is a grand day for cheating," by manufacturers, which is so well understood by the London County Council. Does he work on Sundays? If not, of course, his labours are in vain.

As Lord Beaconsfield once observed, there is something peculiarly significant in statistics of chemical industries.

These are certainly not picturesque objects of either town or country; and their science thoroughly deserves the short nickname bestowed upon it at the ancient Universities. It would, however, be a bad day for the nation if there should be less call upon the labours of Mr. Carpenter and his colleagues. As we have remarked before, the most striking feature of these official returns is the fewness of the separate processes of manufacture to which the voluminous chemical science of our time has given rise. When new processes are devised, they come under the notice of the Inspectors for the same old reasons. The number of scheduled processes does not increase. The tale of works keeps wonderfully level from one year to another. Last year the number of sulphate of ammonia works increased more than any other distinct chemical manufacture.

Claus sulphur recovery figures rather largely in this year's report. In his comments on the chemical manure trade, the Chief Inspector remarks upon the exhaustion of native raw material for the manufacture of superphosphates. All the necessary supply of mineral phosphates is now imported. More displacement of British labour! On the other hand, the exports of sulphate of ammonia—the staple artificial manure of British origin—amounted last year to 162,750 tons; while the home consumption remained stationary at about 68,000 tons. The latter seems a strange result. Mr. Carpenter's observations on the chemistry and physics of coking, after Hilgenstock, are very interesting. This is the important matter published in the "JOURNAL" last October, and referred to by Mr. Carpenter. The increased production of sulphate of ammonia by British gasworks, notwithstanding the growth of carburetted water gas plants, still outweighs the increase from all the other sources of sulphate together. It is rather surprising to find that producer-gas manufacture has hardly begun to occupy the Inspector's attention, though it is expected to do so in the near future.

The Coal Duty, and the Incidence of Taxation.

THERE was a debate on the coal duty in the House of Commons on Tuesday last, chiefly sustained by members identified with the colliery interest. Those who raised it, on a motion to reduce the duty from 1s. to 1d. per ton, had nothing fresh to adduce in support of the contention which, one must charitably suppose, they felt in honour bound to put forward once more, that the impost is detrimental to the trade of the country generally, and prejudicial to their own interests in particular. The chief interest of the occasion centred in the speech of the Chancellor of the Exchequer, who cited the statistics of the export coal trade to prove that neither the volume of this trade nor the employment of mining labour has suffered from the duty, and also that it is entirely borne by the foreign buyer. For us, the particular interest of this demonstration lay in the fact that it confirmed the view of the incidence of the duty given in last week's article on "The Fiscal Problem and the Coke Trade." With one leg of our argument thus strengthened, it is permissible to hope that the other may be found sympathetically invigorated. The whole matter of the fiscal policy of the country centres, of course, in this question of the incidence of any specific tax. We are, meanwhile, able to contribute something from the recent history of the European gas industry to the elucidation of a point touched upon in the recent debate. It was then asserted that there has been a falling off, attributable to the duty, in the Continental demand for North of England gas coal. Whatever may be the extent of the relaxation of the demand for this unique natural product, which is part of the national capital, it is probably due, in greater measure than to any other influence, to the lessened requirements of the London market. As regards any diminution of the Continental demand, this inevitably follows from technical considerations connected with the abandonment in many places of the illuminating power standard for the gas supply. This process has been going on for three years or more, as our gas engineering readers very well know; and it has nothing at all to do with the English export duty on gas coal.

Though it is perfectly true, as has been observed, that the duty on exported coal is no part of the new fiscal policy, which we are all trying our best to understand, it illustrates, probably better than any other tax that could be named, the theory of the incidence of taxation. It has been well said, that "in the controversy about the new fiscal policy, the "lucid statement of fact will play a great part." Already, the mere suggestion of a revision of the traditional views of taxation has had the effect of stimulating in an extraordinary degree the interest of the public in a class of subjects which have long been regarded as belonging to an extremely dull order of abstract studies. It is indeed very easy to get hopelessly befogged amid the theories and explanations of professed economists, especially in the absence of a definite issue. As is the habit of all professors, those who have specialized in Political Economy have usually been prone to slur over the things they did not know, and by way of compensation to express themselves very positively indeed in regard to those they were certain about. It is the text-book fashion. Yet, here and there, an exceptionally candid person of the order has confessed ignorance of some things, the importance of which in practical affairs is embarrassingly great and insistent. Those professors who are more learned than wise dread the disclosure of these shortcomings of their information, lest they should throw discredit upon the rest. This only goes to show that there is a good deal of human nature left in them. Professor Nicholson is very much quoted just now, in respect of his admission that the incidence of a tax is one of the most obscure and doubtful of all the truths of which an investigator in economics can attempt the discovery. Yet it is the one thing needful to the judgment of a fiscal proposal.

We cannot but think that the Chancellor of the Exchequer was "very warm," as children say in their most immemorial "seeking game," in the neighbourhood of a hidden generalization respecting incidence, when he showed that the export prices of coal since 1900 had gone against the purchaser. He said that he gathered from the figures "that the duty of "1s. had been added to the export price, and in that case "the foreigner paid the tax." The generalization which almost came to the surface at this moment is, that the party to a bargain of sale and purchase who is instigated by the preponderance of desire to deal, pays the incidental expenses. It may help to a better perception of this truth of every-day experience if the expenses are considered apart from any question of taxation, which is so hedged about with prejudices, and understood to consist simply of ordinary business charges, including profits and commissions of all kinds, even illicit. The keener the desire of one party to trade, the more will he pay for the privilege. Indeed, this keenness to bring off a deal is the instigation to all manner of transferences of incidental expenses, legitimate and otherwise. The seller, or the buyer, who is in a position to name his price and stick to it, is master of the situation. Hence it is impossible to say, with any regard to the truths of every-day commercial experience, that a tax, or other incidental expense, will always fall on one of the two parties necessary to any bargain. On the contrary, it must fall in some cases upon one, and in other instances on the other party. The conditions govern the incidence in every case. This is only a particular application of the law which Clerk Maxwell declared to be the only universal physical law—that "the greater force overcomes the less." There is no other. Man does not like paying taxes, or any other expense of trade; but he will do it, if it is necessary to the attainment of his purpose. Proverbial wisdom has crystallized the expression of this law of life ages ago in a "saw" which begins "Needs must"—the rest is understood. It is an immense relief to discover in Economic Science a "law" that cannot be broken, and to which there is no exception.

The Latest Disaster to the New Unionism.

AN imperfect acquaintance with "the three R's" was always the inherent weakness of the new Trade Unionism during the brief period of its luxuriant growth in this country, when its leading exponents (of whom Mr. Tom Mann was one of the most conspicuous) hob-nobbed with Cardinals and were objects of attention for editors of "new" reviews. Especially was this weakness shown in its arithmetic; for it was the problem of the eight-hour day "out and out" that floored its professors in the end. The once noisy band of agitators split, divided, and subsided. Some got into Government offices—hours from 10 till 4; and the eight-hour movement interested them no more. A few were fain to put up with the London County Council. Mr. Tom Mann emigrated to Australia, to start a colonial branch of the agitators' business. As the Latin saying goes, men change their skies, but

not their natures. Mr. Tom Mann has lately been heard of again, as the organizer of an unsuccessful strike of Union engine-drivers and firemen on the Victorian Government Railways. It was the same old story of a miscalculation of numbers and forces. The men who placed their trust in the "principle" of Trade Unionism, and the "strike policy" of Tom Mann, had fondly persuaded themselves that they were indispensable and omnipotent. At what they considered a favourable moment, they deliberately entered upon a trial of strength with their employers and the public; and they were hopelessly worsted. It always must be so when a minority of the population attempts to tyrannize over the rest, and is firmly met. The dream of New Unionists is of universal domination. Ostentatiously scorning the ideals of the societies of real tradesmen, they aim at nothing short of complete mastery of all the sources of wealth by the employment of labour, so that they may inherit the earth upon terms of their own dictation. The means by which this conquest is sought is a Universal Strike. At one time, it was thought that the way to this lay through a Universal Union, which was accordingly started under the name of the "International"—once a word of fear for imaginative novelists to conjure with. If there are still readers of the social works of Bulwer Lytton, they will recall the vague fears of the "International" which found utterance in some of these romances.

This plan failed, for many reasons; and then it was sought to build the new Tower of Babel from the bottom. Particular unions, not of tradesmen, were started, and afterwards amalgamated and federated. It was always to the same end—the gathering up of all power over the multifarious descriptions of "workers" into but few hands, for effective combined action. This second plan looked more promising for a time, owing partly to the supineness of some employers and the timidity of others. The sympathy of a considerable portion of the public was also engaged by the sentimental professions of some of the spokesmen of the new movement. In due course, however, warnings of danger appeared, in the shape of isolated acts of arrogance and oppression. The vanity of the leaders could not resist the luxury of trying their strength; and they failed all along the line. This latest disaster is the greatest of all. The field of action was a system of railways "nationalized" after the Socialist's heart. The objects of all the resolutions favouring State employment which the Trade Union Congresses in England pass with such monotonous and futile regularity, are realized in Victoria. The railway men there are public servants; and they rebelled against their master, the State Government, for their own ends. They made a fatal mistake, and after a short struggle surrendered ignominiously. The lesson has been a severe one; but it is to be hoped that it will prove of lasting good to the Commonwealth. Still, of course, it is impossible to speak confidently in this sense. The labouring classes of new communities, who feel their political power, must learn the lesson that monarchs and nobles, the priesthood, and the middle classes, have all been taught, by long and painful experience—that class government in its own selfish interest does not work. The only question is, how long (and at what cost) it will take them to learn it.

The Bermondsey Clause.

The wise act of a Lords Committee in putting into the Bermondsey Electric Lighting Order of 1902, at the instance of the South Metropolitan Gas Company, a clause which compels the Borough Council to work their electric lighting undertaking so as to be self-supporting, has already formed a very useful precedent; and it is to the highest interest of all gas companies that they should not miss an opportunity for making an endeavour to realize the protective benefits of this enactment. Frequently, although the utmost care has been taken to keep our readers posted on all that has transpired in connection with this important matter, communications have been addressed to us asking for information upon it, and for references to the published statements respecting it, which statements are scattered through the numbers of the "JOURNAL" for the past year. In view of the widespread interest taken in the matter, and its importance, it was a happy thought on the part of Mr. Vincent R. Balfour-Browne that he should bring within the compass of a single article in the "JOURNAL," the whole history of the clause and of subsequent successes. This he has done in language and manner plain and to the point; and the compilation, which appears elsewhere in this issue, will be highly valuable to gas companies. For it we thank him, and may at the same time express the hope that, when opportunity offers in connection with this or other legal or parliamentary questions affecting the gas industry, he will not fail to give our readers some of the further produce of his pen. The patronymic of the writer of the article will be recognized as one that has had a close association with the legislation of the gas industry; and there is an appropriateness in the present authorship, for it was Mr. Vincent Balfour-Browne's father who was instrumental in securing, for the benefit of the South Metropolitan Gas Company and the non-electricity-consuming ratepayers in Bermondsey, the insertion, in the Borough Council's Electric Lighting Order last year, of the clause which has since created so much sensation in electrical circles. The eminent K.C. has also since been the mouthpiece in urging the justice of the clause; and one of the features for gas people of the doings in the Parliamentary Committee rooms this session, has been the ease with which he, by his clear exposition of the position, obtained the acquiescence of a Lords Committee to the insertion of the clause in the Willesden District Council Bill.

Profits for the Consumers.

With the last sentences in Mr. Vincent Balfour-Browne's article, we, at all events, are not prepared to quarrel. They only state in another way what the "JOURNAL" has contended for over a long number of years in connection with municipal gas supply. If the local authorities operating under this clause are not allowed to fall back on the rates in the case of loss, then, in common fairness, the users of electricity, having to meet deficiencies, should be entitled to the benefit of any profits that may be made by the undertaking. Our learned contributor cannot find that any provision has been made in this direction. We devoutly wish he could. It is the natural supplement to the Bermondsey clause. We will go further and say that nothing would give us greater pleasure than to see the Bermondsey clause *plus* Mr. Vincent Balfour-Browne's suggestion applied to every municipal gas undertaking in the Kingdom. It would fit in very nicely with the policy persistenly advocated by the "JOURNAL" for many years past. The faces of our municipal friends will be wreathed in smiles as they read this, and contemplate their position were such a catastrophe to overtake the local exchequer. The tying up of the profits for the benefit of the electricity consumers alone—right though it would be—would be a heavier blow than the Bermondsey clause itself. Let it once be applied to electricity by Parliament, and its application to other departments of municipal trading would be strenuously fought for. And then, if successful, where would municipal trading be? The prospect is too good to dwell upon; but who knows what may happen? Twelve months ago to-day, no one but those in the know were looking for the Bermondsey clause; and may be even those in the know were not doing so very hopefully. Three days later, it was part and parcel of the Borough Council's Order!

Municipal Trading in General

Nowadays no public speech—whatever the subject, and whatever the occasion—can be considered complete that does not contain some reference to municipal trading. This is a question which, from causes that should by this time be perfectly familiar to our readers, has forced itself to the front—and threatens, for some time at least, to remain there. Not even the keenly debated subject of Free Trade or Protection is able to hustle it from its place. For all this, however, we must confess that we should not have expected the annual meeting of the shareholders in Kynoch, Limited, to have added a great deal to the discussion. But this only shows how easily one may be mistaken; for the speech of the Chairman (Mr. Arthur Chamberlain) dealt to a considerable extent with municipal enterprise in general, and the policy of the Birmingham Gas Committee in particular. After stating his opinion that the home market in the goods which the Company had to supply was for many reasons better worth cultivating than foreign trade, he hastened to add that notwithstanding this they must not quote him as always praising the local authorities; for he had come across an instance which showed how the profits were made that their friends the

Birmingham city councillors boasted of, and from which they claimed that they contributed to the relief of local taxation. There were two ways of making profits; there was the legitimate one of practising economies and good management, and there was the other method which was only possible where there was a monopoly—simply raising the price to the consumer. It was the latter method, Mr. Chamberlain contended, which had been followed by the Birmingham Gas Committee; and when the Corporation talked of making a contribution to the rates of something like £30,000 per annum on an average of years, they had to remember that this sum was first of all taken out of the profits of the gas consumers, who were also the ratepayers, and then placed to the credit of the business ability of the Council as a profit that they had earned by their municipal enterprise. This is a view of the question of municipal gas supply which has many times been emphasized in the pages of the "JOURNAL"—indeed, it is so obvious that the only wonder is that anyone should fail to see it. Coming to the bearing of his remarks on municipal trading, Mr. Chamberlain reminded those present that originally in Birmingham they had two Companies, who were competing; and if one fell behind in the purity of their gas, it was to the interest of the other to keep it up, and they would have been able between the two to put some pressure on. This might have been very nice if the Companies in question had been content to go on cutting one another's throats; but this is a thing which in similar circumstances usually did not happen. Competing gas supplies, in this country at least, never benefited the consumer, who in the end invariably found himself called upon to bear the burden of a double capital outlay without enjoying the promised advantages of competition. Be this, however, as it may, Mr. Chamberlain's next argument is easier to understand—namely, that under a company the consumers, if they had anything to complain of, might rely upon the support, sympathy, and assistance of the local authority; whereas now in Birmingham they had to go to the very Council who were responsible for that of which they complained. Though even here it must be pointed out that, as the majority of the gas consumers are doubtless ratepayers, they have the power (if only a means could be devised of persuading them to use it) to press their complaints forcibly upon the Corporation at election time.

And Birmingham Gas in Particular.

But what was the reason for this attack by Mr. Chamberlain on the Birmingham City Council? Why, simply that he had been making a comparison between their gas and that supplied in Manchester—greatly to the advantage of the latter. Manchester has not always been thus fortunate in discussions of this character; but then in the previous instance which comes to our mind the comparison was with a company. Anyhow, though Kynochs in their works use chiefly electricity for lighting, they employ gas for heating and power purposes; and in view of its great advantages in these respects, a considerably increased consumption of town gas is contemplated. Before committing themselves, however, they thought it desirable to ascertain the value of this gas; and, as the result of a number of observations, they ascertained, "to their surprise and sorrow, that the heat value of Birmingham gas was only 587 British thermal units," which represented a very impoverished article. The heat value of Manchester gas, on the other hand, was 653 British thermal units; and the price at which it was supplied was 2s. per 1000 cubic feet, as against an average charge in Birmingham (without allowing for discount) of 2s. 4d. "If they worked out as a sum in proportion the Manchester gas of 653 B.T.U. at 2s., they would find that the Birmingham gas, with its impoverished 587 B.T.U., ought to be supplied to them, to be equal in price to Manchester, at 1s. 9d. per 1000 cubic feet; and therefore they were paying 7d. per 1000 cubic feet more than its value in a city comparable with their own." This indictment of the Birmingham Gas Committee has not been allowed to pass unchallenged by the Chairman (Mr. C. T. Bishop); for he writes to the Birmingham papers pointing out that in Manchester only gas for power purposes is charged at 2s. per 1000 cubic feet, the rates for ordinary consumption being much higher. He contends that the concession in price made to users for power purposes can only have been granted at the expense of other consumers; but the policy of the Birmingham Gas Committee has always been to supply gas at the same price to all consumers, regulated by the quantity taken, and regardless of the purpose for which it is used. This price now ranges from 2s. 9d. down to 2s. 3d. per 1000 cubic feet, less 5 per cent. discount for prompt payment. Mr. Bishop admits that the illuminating power of the Manchester gas is higher than that of Birmingham; but, on the other hand, the cost of manufacture is much increased in the latter city owing to the distance of the coalfields from which suitable material can be obtained for gas making. This is where the matter rests at present; and it remains to be seen whether the Chairman of Kynoch, Limited, will carry out his veiled threat to draw upon "the resources of civilization" to the extent of putting down a carburetted water-gas plant on the works, rather than continue to take a supply from the Birmingham Gas Committee.

Vitality at Plymouth.

There is nothing which savours of decay in the affairs of the Plymouth Gas Company. Those responsible for the management of the undertaking are bent upon maintaining the good reputation which it has gained; and in this they promise to be eminently successful. Plymouth has for long been cited as an example of what should be in matters of gas supply, both from a consumer's as well as from a shareholder's point of view; and this is not to be wondered at, when account is taken of the policy which animates those at the helm. This policy is one of progress and unceasing activity, not of sitting down with folded hands waiting for the business to expand of its own accord. As the Chairman (Mr. J. A. Bellamy) remarked at the recent meeting—a full report of the proceedings at which appears in another part of to-day's issue—such results as the Company are able to show do not grow of themselves, but call for a good deal of thought and devotion on the part of the officers and Directors. Of course, they do but seeing the reward which follows such thought and devotion, these good qualities cannot be said to be in any way wasted, when exercised in the service of the gas industry. They are necessary to the welfare of any business, but more especially to that of one which is attacked by such an "enemy" as electricity. Mr. Bellamy is not afraid of the competition of electricity, if conducted on a fair basis, and in all probability he is right in the view he takes of the matter; for if the electric light should succeed in seriously injuring an undertaking occupying the strong position the Plymouth Gas Company do with regard to the sale of their commodity, it would indeed be a bad outlook for concerns less advantageously situated. Even with gas, however, at 1s. 9d. per 1000 cubic feet (to which price it was reduced from 2s. as from March last year in Plymouth), the Corporation have succeeded in getting as customers for electricity the tenants of a number of shops and private houses, which shows once more that cost is not the sole factor that decides everybody in the choice of an illuminant. But the great majority of people are, and must of necessity be, governed mainly by monetary considerations; and therefore the companies who are able to supply gas at the cheapest rate are the ones who have the least reason to fear competition. In spite of the electric light, the profits of the Plymouth Gas Company for the past year show an increase of no less than 41 per cent. over those for 1898, and 81 per cent. over those for 1899. Another fact that is greatly in favour of the Company is that, in a Bill which is now awaiting the Royal Assent, they have succeeded in getting the illuminating power of the gas reduced from 15 to 14 candles, without any lowering of the standard price—thereby occupying a position among gas companies which is unique. Originally, the intention was to apply for a reduction from 15 to 13 candles; but as this would have involved an alteration in the standard price, a change to 14 candles was decided upon with the existing standard price, and this proposal met with no opposition from the Corporation.

Some Suggestions.

After having dealt exhaustively with the affairs of the Plymouth Gas Company, Mr. Bellamy turned his attention to some of the questions which affect the industry generally, and which from the mere fact of being everybody's business are so very apt to become nobody's business. He is fully qualified to offer a sound opinion on the matters to which he referred; and therefore we commend the latter part of his speech to the earnest consideration of all readers. In the first place, he calls attention to the lack which is to be found in the gas industry as a

whole of a co-operative spirit in offering inducements to inventors. He thinks, and he has found others who agree with him, that it is desirable that something should be done in this direction, and he invites the gas journals to take the matter up, "and get the gas companies to co-operate in offering substantial prizes for special kinds of invention." It is very possible that some real good might be accomplished on the lines suggested by Mr. Bellamy; and we may therefore take another opportunity of referring to the matter after fuller consideration. Nothing that we feel ourselves able to accomplish (and that seems to come fairly within our province) in promoting the welfare of the industry will be left undone; and whatever may be the outcome of Mr. Bellamy's present suggestion, we must express our hearty thanks to him for having made it. That there is urgent need for the aid of inventive brains in various directions, no one will deny. Mr. Bellamy suggests certain fields of operation; and pending the preparation of some such scheme of co-operation as proposed, perhaps the remarks he has made may serve to stimulate the efforts of inventors. There should be a very fair reward to be derived in the ordinary course of business from the satisfactory solution of the problems indicated (without taking into consideration the substantial prizes which it is suggested should be offered), if all undertakings were as keenly on the look-out for improvements as is the case with the Plymouth Gas Company, and were not, as Mr. Bellamy puts it, inclined to "wait twenty years to see what a thing was worth" before adopting it.

Engineering Training.

A paper which appealed to all sections of the recent Engineering Conference was read by Professor J. Dewar Cormack on "Apprenticeship in Engineering"—the word apprenticeship being intended to include all undergoing training for the profession. The paper did not throw any new light on the subject; the only thing it did was to emphasize the diversity of the ways in which a youth in the present day may enter engineering. It has come to be generally recognized that the proper training of a young engineer involves both theory and practice; and the finished product should be (as was appropriately expressed by Professor Cormack) a blend of scientific and technical knowledge, practical experience, and business method. The last two, of course, can only be acquired in the workshops and offices; and no training can be considered efficient that does not include a considerable period of practical apprenticeship. Colleges may supply knowledge relating to the properties of materials, the theory and structure of machines, instruction in testing, and in the methods of attacking new problems; but it is only under actual commercial conditions that there can be acquired the proper type of practical experience, adequate knowledge of the design and construction of machines, and experience of and sympathy with workmen. The duration of the training of the engineer, of course, depends upon the arrangement of the course; and to produce the ideal young engineer, the training should, Professor Cormack thinks, be extended over five or six years, which (in his view, though not in that of many of his audience) might possibly be equally divided between college and workshop. The various systems in operation in this country were classed and described by the author; and for all of them advantages and disadvantages were, in the paper and the discussion, freely presented. However, the practical men who spoke, while they did not hold with the survival of the old traditional workshop training only, were favourably disposed to the young engineer spending the greater part of his years of training in the workshop rather than in the college, and to the use of machines being learnt under commercial conditions, which has the collateral advantage of producing a knowledge of works' administration. The weight of opinion, too, appears to be on the side of the college training coming after the workshop course. From his large experience at University College, Professor Kennedy is convinced that, if a youth has a year or two in the shops or office before attending college, he is afterwards a better learner. He emphatically adds that youths who attend the college direct from school—say, at seventeen years of age—"not only know little, but they do not know how to learn." Neither the paper nor discussion has relieved us of the chaos both in opinion and practice that exists on this subject of the training of the young engineer; but it is clear that the practical training, in the view of the men who have won high places in the profession, must have precedence in both measure of time and place over the theoretical, but this must not by any means be neglected. Perhaps some more generally recognized system of apprenticeship could be devised to suit the conditions of to-day; but any attempt to standardize training too rigidly would result in failure to produce for all branches of the profession the "blend of knowledge" required in them.

Begging for the Holidays.

We should be very glad to hear from some of our commercial friends that the begging system in the gas industry is on the wane; but the sample circulars which reach us from them do not give any indication that it is. One of the circulars to hand this week is about as brazen-browed as any that has come before us; but in fairness it should be said that it did not emanate from a gas-works. It was, however, addressed to a firm of gas-engineering contractors, who about two years since received a small order from the Company whose employees are about to have their annual holiday. Further orders from the same source have been conspicuous by their absence. But nevertheless the little transaction has not been forgotten—on one side, and twice have the contracting firm been pestered for subscriptions to the men's outing. The first time the solicitation was direct from the Secretary of the Company; and this year through an "Hon. Secretary." The latter says—and no doubt means what he says—that he will be pleased to receive on behalf of the employees of the Company any contribution which the recipients of the letter may be disposed to give. As the contracting firm referred to are unlikely to be disposed to give anything, the pleasure which Mr. Hon. Secretary will derive from this quarter can be measured fairly accurately. But we are reminded that the boot is sometimes on the other leg—that the importunity comes from the contracting firms, and the importuned are gas-works proprietors. We do not think this can be said of any of the representative firms immediately identified with the gas industry. The instance brought to notice has reference to a firm with apparently only a local connection, and a reputation that has not extended beyond their own district so far as the gas industry is concerned. The employees in this case, through their "Joint Secretaries," put the matter thus to the Gas Company and others whom they addressed: "The staff of ——— propose having their annual outing, and as the Company have had transactions with you, we beg, on their behalf, to solicit a donation towards the expense." Although it is left to the choice of the reader to apply the second pronoun "their" to either the Company or the staff, the meaning of the writers is clear, their solicitation blunt and impertinent, and the ground for making the application to the Gas Company in question unreasonable and ridiculous. These two examples of this particular form of impudence are sufficient for the week.

The Present and Future of the Hastings Gas-Works.—In connection with the series of articles which have recently appeared under this heading, the drawing of the roof that was given on p. 581 showed the dimension between the piers as 72 feet. This should be 70 ft. 6 in., as 72 ft. is the space between the walls proper. On p. 662, the drawing of the coal-store roof was given correctly; but since the notes were taken from which the articles were written, Messrs. S. Cutler and Son, the Contractors, have found it possible to use rolled-steel joists for the roof rib instead of as described. Thus the drawing (which is correct) is a contradiction of the statement in the article.

Spiral-Guided Gasholder at Romford.—We learn from Mr. W. D. Child, the Engineer and Manager of the Romford Gas Company, that Messrs. R. & J. Dempster, Limited, of Manchester, have recently completed for the Company a three-lift spiral-guided gasholder of the following dimensions: Inner lift—Diameter, 97 ft. 6 in.; capacity, 164,250 cubic feet; weight, 71 tons; pressure, 41-10ths. Middle lift—Diameter, 100 feet; capacity, 161,000 cubic feet; weight, 37 tons; pressure, 67-10ths. Outer lift—Diameter, 102 ft. 6 in.; capacity, 165,000 cubic feet; weight, 40 tons; pressure, 82-10ths. The total capacity is 490,250 cubic feet. The holder was inflated with air last Saturday, for the purpose of testing it. The appliances used were a 15-horse power steam turbine and a No. 6 Sturtevant blower—being a portion of the carburetted water-gas plant at the works; and the blast-pipe was temporarily connected to the inlet of the holder. In this way the three lifts were completely filled; 500,000 cubic feet of air being blown into the holder in 2h. 20 min. Mr. Child believes that this constitutes a record in gasholder lifting, and it furnishes interesting statistical particulars of the quantity of air delivered against pressure by a fan directly coupled to a high-speed motor.

ESSAYS AND REVIEWS.

THE GAS AND WATER STOCK MARKET.

(For Stock and Share List, see page 976.)

THE general position of things in the Stock Exchange last week certainly showed an improvement; and while some departments which had been rather weak scored an advance, others which had been falling heavily now checked their downward course perceptibly. So that the close of the week was much brighter than of late. Business, however, was at no time brisk; and the fornightly settlement was the chief consideration. This seems happily to have given rise to no difficulties. The Money Market was very brisk and active, as might be expected at this time; and there was a strong demand in connection with the Stock Exchange settlement and the usual requirements at the close of a half year. But after these have been met, pronounced ease might fairly be expected; and this may have a favourable influence in the Stock Markets. In the Gas Market, business was only very moderate; and though at one time it began to promise better things, the effort died away to nothing. Changes in quotation were few in number and slight in degree, and they were about as many in one direction as in the other; so that no general tendency was indicated. In Gaslight and Coke issues, the ordinary opened at 86, and jogged along sleepily till the quotation dropped a point for lack of support. It then roused a little, and the final marks were pretty well as good as the opening. The secured issues were very moderately in evidence, and they moved irregularly, the preference receding a point, while the debenture gained one. South Metropolitan was moderately active compared with the general average, and steadily advanced from 119½ to 122; but the quotation did not move. There was nothing noteworthy in Commercials. In the Suburban and Provincial group, there was hardly anything doing; and except that Plymouth came out a point better *ex div.*, there was no change. The Continental Companies were very little dealt in, and were quite devoid of incident. In the undertakings of the remoter world, an advance in Buenos Ayres debentures was the only feature. In the Water Companies, movements were at first rather shifty, and it looked as if things were in for a fall. Then came a sudden rush upon Southwark, and dealings were very brisk, with a closing result of 4 points gained on the quotation.

The daily movements were: On Monday, all was quiet, and there was no change in quotations. On Tuesday, Gaslight preference fell 1. In Water, East London, Southwark, and West Middlesex debenture fell 1 each. On Wednesday, Crystal Palace debenture advanced 1, but was put back next day, when Gaslight ordinary also fell 1. In Water, Chelsea 4½ per cent. preference rose 2½, and Southwark 1. On Friday, Buenos Ayres debenture rose 1. Southwark Water rose 2. On Saturday, Gaslight debenture rose 1. In Water, Southwark rose 2 more.

ELECTRIC LIGHTING MEMORANDA.

Mr. Vincent R. Balfour-Browne on the Bermondsey Clause—Is the Clause a Restraint upon Trade?—The False Pretence of Municipal Traders in Electricity.

IN view of the inquiries that are from time to time addressed to the "JOURNAL" for particulars of the Bermondsey clause, attention is invited to the comprehensive explanation of the origin and legal aspects of the famous clause to be found in another column. It is contributed by Mr. Vincent R. Balfour-Browne, son of the leader of the Parliamentary Bar, who was instrumental in prevailing upon the Lords' Committee to insert the clause in the Electric Lighting Order of the Bermondsey Borough Council of last year. It is no disparagement of this triumph of advocacy to be reminded that the principle of the clause did not originate with this occasion, but dates from 1898 and the Dundee and Broughty Ferry Tramways Act of that year. It was contended on behalf of the North British and Caledonian Railway Companies, in opposition to the proposal of the Dundee Corporation to take over and work these tramways, that they actually competed for traffic with the railways. This was all very well so long as the tramways belonged to a Company living on their own resources, like the Railway Companies themselves. But the conditions would be materially altered if the Dundee Corporation were permitted to acquire the tramways in question, run them at a loss with the express object of taking away the business of the Railway Companies, and make the latter contribute as ratepayers towards the cost of ruining their own trade. It is no wonder that this proposition struck the Committee as unfair, or that they willingly accepted a clause drafted to prevent the contingency. The Rhondda Tramways Act, 1902, which was commented upon in this column some time ago, contains a much stronger safeguard against the same kind of municipal malpractices, for the reason that the Bill was believed to have been promoted with no other object.

We do not agree with Mr. V. R. Balfour-Browne's statement that electric tramways "have proved wonderfully successful," both in the hands of companies and corporations. A sufficient length of time has not yet elapsed for anybody with an eye upon the future as well as on the present show to speak confidently on this question. Not until time brings out the secret of repairs and maintenance, and puts the world in possession of a really practicable motor car, will it be possible to tell the fortune of electric tramway traction. As regards the position of municipal electric lighting undertakings, of course, there can be no disputing the soundness of our learned contributor's judgment. Indeed, to state that this particular order of municipal trading enterprises has often disastrously failed, is putting it very mildly. It would be nearer the whole truth to aver that the number of municipal electricity supply undertakings which are really solvent is a very small and select minority, not likely to be increased. Doubtless, Mr. Balfour-Browne hits the nail on the head in asking himself whether the principle of the Bermondsey clause and its analogues lends itself to trade at all. To ask the question is to answer it in the negative. The principle of these clauses is not a commercial one. As he points out, it is "a little crude" to enact that if a business does not pay at low prices for its commodities, the prices must be raised to make it pay. This is the direct contrary of sound commercial practice. It must not be overlooked, however, that the class of business in the case is monopolistic. The trade in electricity for lighting or tramway traction is effectually "cornered" when the local authority get hold of it; so that the usual principles of commercial enterprise apply to it "with a difference." It is the extent of the difference which is in question. Those who "corner" a commodity are on their peril to keep their squeeze from strangling the trade.

Theoretically, Mr. Balfour-Browne is right is taking this view of the Bermondsey clause; and, in the same sense, the Board of Trade are equally right in refusing to put it into their Electric Lighting Orders. In practice, however, it will probably not be found so odious. The temptation which besets local authorities engaging in electricity supply or tramway working is to cut prices to unremunerative figures. It is notorious that all the Metropolitan Boroughs doing their own electric lighting wish to make out that their charges are less than those of the London Companies in the same line of business. The London County Council abet them in this pretension; and only the other day they dressed up a statistical return which had no other object than that of supporting this utterly false and misleading view of the results of electric lighting by the London Boroughs. The truth is persistently ignored that while the electric lighting companies have to earn their own living, do all their own work, and pay at least their full share of local rates, the local authorities do none of these things. A very curious vista is opened up by Mr. Balfour-Browne's suggestion that corporation profits on electricity supply, if any, "ought not to go to the benefit of the ratepayers generally, and therefore to the gas company among them." There is something piquant in this idea of gas companies ever benefiting as ratepayers from profits of municipal electric lighting; unfortunately it never happens. Gas companies in places where the electric lighting is done by the local authority would be well content to forego any share in these hypothetical profits if they could be assured that they would never be called upon to bear any part of the very real loss Nor would it answer their purpose if, as the Bermondsey Borough Council offered, in their desire to buy off the opposition of the South Metropolitan Gas Company, they were specially exempted from any levy in aid of electric lighting losses. The exemption would be illusory to begin with; inasmuch as a good deal of the expense of carrying on municipal electric lighting is never shown in the accounts of this particular department, but is hidden away under such heads as street paving, dust destruction, town improvements, and town hall expenses. Nor would it be fair in any case, to the business of a gas company, for the local authority to compete with them by offering electric light at less than its cost. This is done, of course, almost everywhere; but it behoves the gas company to oppose the unfairness whenever they have the chance. The only sound conclusion to be drawn from these discussions on the principle of the Bermondsey clause is, that if it is going to hurt the cause of municipal trading to insist that it shall not be carried on to the injury of the ratepayers, the whole thing had better be given up as impracticable. There is no logical halting-place short of this. Meanwhile; if those trading authorities who have no Bermondsey clause to respect would only be content to try and make both ends meet; without at the same time coveting the reputation of underselling the companies it would redound to their credit.

Carburetted Air for Lighting and other Purposes.—Dr. Marshall, of Edinburgh, read a paper before the Edinburgh University Chemical Society on Monday, the 22nd inst., on "The Use of Carburetted Air for Lighting and other Purposes." He showed, and described various lamps designed for burning air carburetted by being passed over blocks of porous material saturated with petrol or other highly volatile hydrocarbons. In some of them the vapour is supplied to the burner by gravity; but in the more recent designs, the draught caused by the burner draws the vapour upwards from the carburettor. He also illustrated how installations of the light could be fitted up in country houses, in the same way as an ordinary gas supply.

THE GRANTON WORKS OF THE EDINBURGH AND LEITH GAS COMMISSIONERS.

DESCRIPTION PREPARED

BY

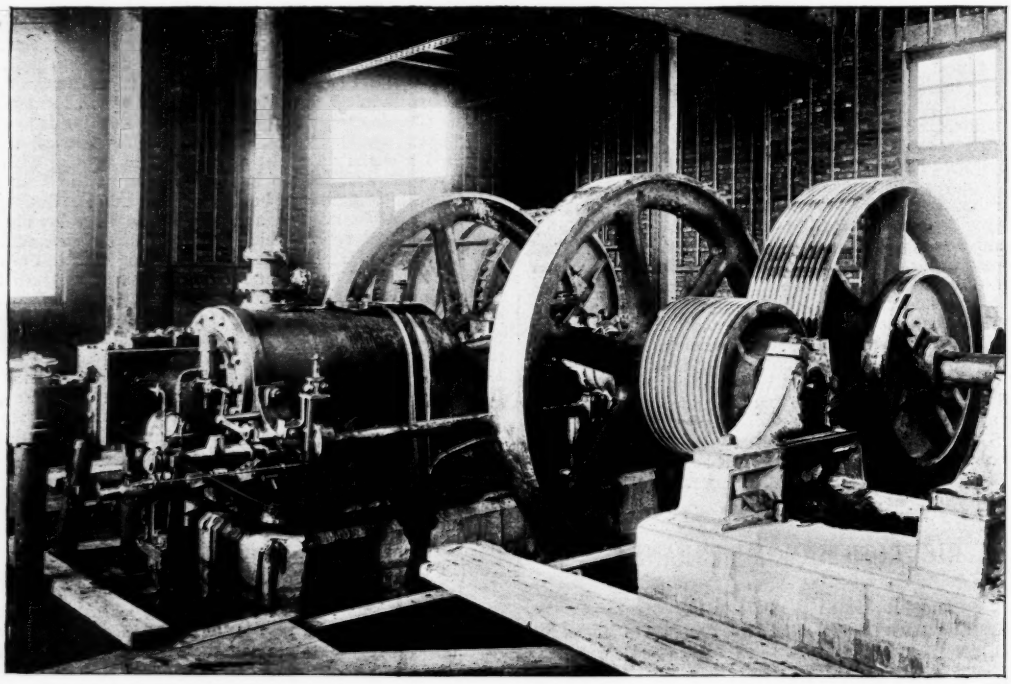
WALTER RALPH HERRING, M.INST.C.E., *Engineer.* *

ARTICLE XXIV.—Accompanied by Page Illustration of the General Arrangement of the Plant, Machinery, Mains, and Valves in the Pumping Station.

The Granton works are situated nearly three miles from the central distributing station, which has been coupled up to the new works by means of a 48-inch diameter cast-iron main, which has been laid to ultimately work up to a gas pressure of 5 lbs. on the square inch. From the central distributing station, trunk mains diverge—one, a 20-inch, to the Leith gasholders and central point of supply, a distance of $3\frac{5}{8}$ miles from Granton; another, partly 30-inch and partly 24-inch, goes forward, *via* the New Street works, to the Holyrood gasholder station, about 5 miles from the Granton works; and the same main continues as a 15-inch direct to Portobello, a distance of rather more than 8 miles from the Granton works.

Three of the four lifts of the Granton gasholder, representing a storage capacity of rather more than 5 millions, give a pressure of 70-10ths; whereas three or four of the two-lift intown gasholders of 1 million feet capacity give a pressure of 74-10ths.

The total demands for gas during the lighting hours in the winter season approximate to a million cubic feet per hour between lighting-up time and about six o'clock in the evening. To ensure a satisfactory supply, it was, therefore, necessary to arrange for the propulsion of gas into the city and district in the quantities likely to be required at any time. A pumping station had, therefore, to be provided; and in view of the fact that it was our desire to deliver increasing quantities of gas as circumstances demanded, at an increased pressure of gas in the 48-inch main, instead of laying further extensions of this character, pumping exhausters of ample capacity, and of such strength as to ultimately work up to a maximum pressure of 5 lbs. on the square inch, were determined upon.



PHOTOGRAPH No. 125.—One set of gas-driven pumping exhausters, illustrating the frictional driving-gear.

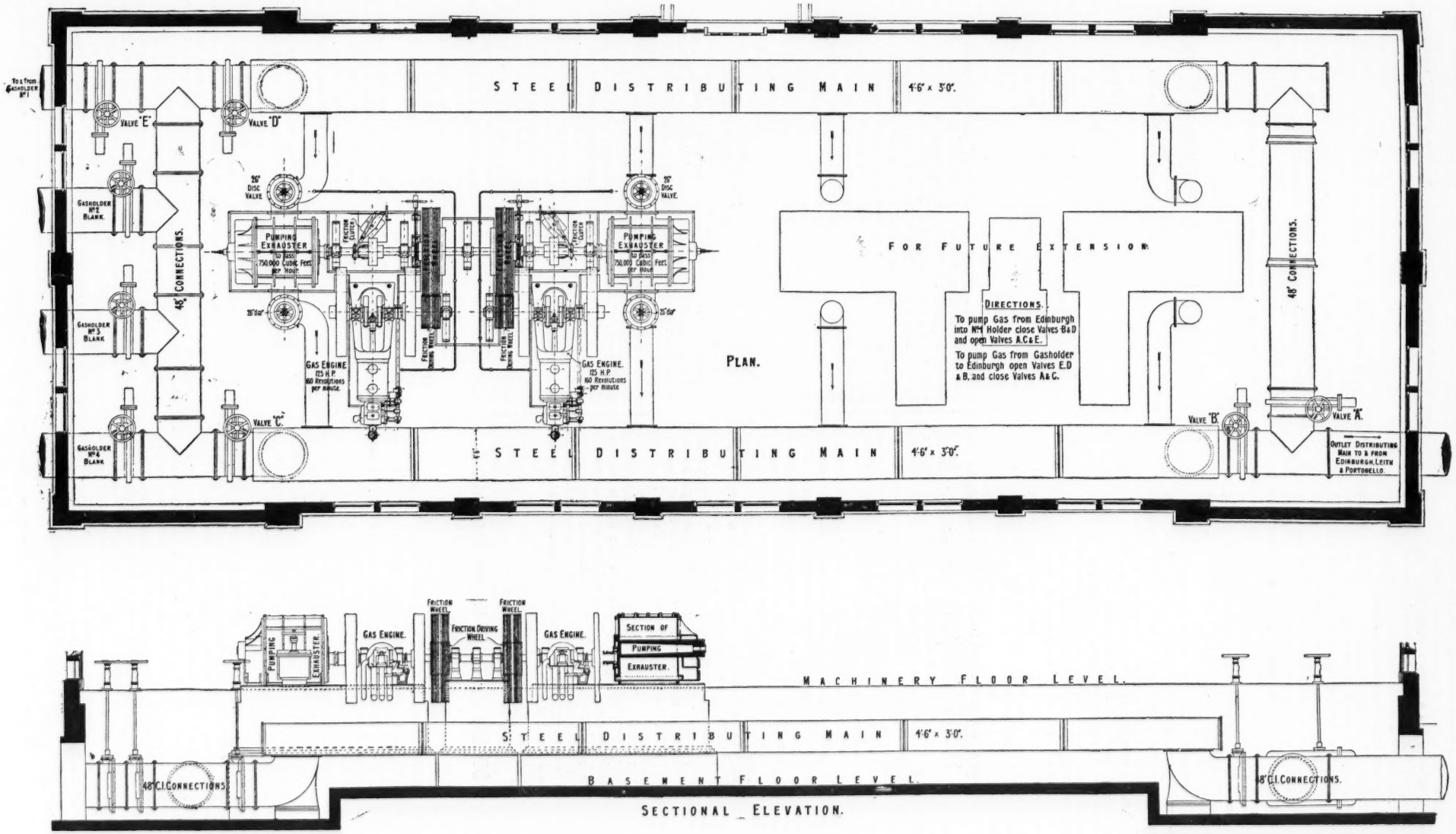
Owing to my desire to concentrate the steam-generating plant in one part of the works—the position in which the pumping-station required to be placed being some distance from this source—it was determined to introduce gas-engines for manipulating this portion of the plant. The exhausters were specified to be each capable of delivering 750,000 cubic feet of gas per hour at a normal pressure of 30 inches at the end of the 48-inch main, nearly 3 miles away; and as they were to be designed for ultimately working up to a pressure of 5 lbs. on the square inch, the idea of strap-driving was out of the question. My original specification provided for a system of gearing that would run the exhausters at 60 revolutions per minute—the gas-engine running 2 to 1; the engine being first started without load, and the load applied by means of friction-clutches. The successful Contractors for this plant, however (Messrs. R. Laidlaw and Son, of Glasgow), in consultation with me, suggested the introduction of frictional gearing in lieu of spur gearing; and, after looking carefully into the matter, I determined to adopt this method of driving, as being more advantageous and safer than spur-driven appliances of this character.

The general arrangement of the pumping-station plant and mains is shown upon the accompanying engravings. At the outset, it was necessary that the plant should be able to both draw gas from Edinburgh into the new holder at Granton as well as propel it from Granton into Edinburgh. The question of reversing the exhausters or the engines was impossible; steam not being employed. But, by a simple arrangement of connections, as shown, the purpose was accomplished by the mere manipulation of a few valves—the engines and the exhausters always running in the one direction. Placed at one end of the building, and communicating with the four gasholder outlets (one from the gasholder that exists and the others from holders that some day may be), there is a system of 48-inch valves and cast-iron connections. These connections communicate with a rectangular steel main running lengthwise on each side of the building, from which the inlet and outlet exhauster connections reach out to the base of the valves attached to the exhausters. At the opposite end of the building, the two exhauster feeding-mains are coupled by means of a 48-inch pipe and connections; the final outlet supplying the gasholder stations being seen in the lower right-hand corner of the engraving.

The method of working the plant for the different purposes (either suction or delivery) is enumerated on the engraving, and the sequence of the operations is as follows: The valves A, B, C, D, E are all open. The attendant, single-handed, starts the gas-engine to work, on the crank-shaft of which a friction pinion is keyed; the engine in the first instance running without load. The engine being started, the large frictional driving wheel of the

* All Rights of Reproduction Reserved.

The Granton Works of the Edinburgh and Leith Gas Commissioners.


STEEL DISTRIBUTING MAIN 4'6" x 3'0".
VALVE "E"
VALVE "D"
GASHOLDER No 2 BLANK.
GASHOLDER No 3 BLANK.
GASHOLDER No 4 BLANK.
48" CONNECTIONS.
30" DISC VALVE
15" DISC VALVE.
PUMPING EXHAUSTER TO PASS 750,000 CUBIC FEET PER HOUR
FRICTION CLUTCH
FRICTION DRIVING WHEEL
GAS ENGINE. 175 H.P. 160 REVOLUTIONS PER MINUTE.
VALVE "C"
PLAN.
FOR FUTURE EXTENSION
DIRECTIONS.
To pump Gas from Edinburgh into No 4 Holder close Valves B & D and open Valves A.C & E.
To pump Gas from Gasholder to Edinburgh open Valves E.D & B. and close Valves A & C.
VALVE "B"
VALVE "A"
OUTLET DISTRIBUTING MAIN TO & FROM EDINBURGH, LEITH & PORTOBELLO
FRICTION WHEEL.
SECTION OF PUMPING EXHAUSTER.
MACHINERY FLOOR LEVEL.
BASEMENT FLOOR LEVEL.
48" C.I. CONNECTIONS.
SECTIONAL ELEVATION.

GENERAL ARRANGEMENT OF THE PLANT AND CONNECTIONS IN THE PUMPING STATION—SHOWING THE VALVES, &c.

exhauster is—by means of an eccentric motion and screw-action—put into gear with the engine. Thereafter, by means of a Croft and Perkins "Crown" friction-clutch, the exhauster is actuated and put to work; the gas in the meantime being simply circulated from the inlet to the outlet main in circuit.

Assuming that gas is required to be delivered to the intown gasholder stations, the attendant leaves his engine and proceeds to close valve A. Thereafter, he approaches valve C, and partially closes that until he obtains on the pressure-gauge the resistance to which he is instructed to work. For instance, supposing the full quantity of gas—750,000 to 1,000,000 cubic feet per hour—was required in town, valves A and C would be completely closed; but in the event of our wanting only 300,000 to 400,000 cubic feet per hour, valve C is partly opened to allow a certain quantity of the gas which the exhausters are propelling at the time to bye-pass—the speed of the exhausters, in consequence of gas-engine driving, being constant.

The attendant throughout the time that pumping operations are proceeding, watches the pressure-gauge. This gauge is fitted with an automatic appliance, which sets an alarm bell ringing when the maximum pressure is exceeded; the pressure of resistance, and the alarm-bell attachment, being fixed and adjusted from time to time in accordance with the requirements of the intown supply. In the event of any of the gasholders in the intown stations being shut off, the pressure at the pumping-station, of necessity, increases. The operator—watching the gauge, which is placed close alongside the operating valve—opens the latter as the pressure increases, and allows a greater quantity of gas to bye-pass until, in the event of all intown stations shutting off, the operator would have completely opened the bye-pass valve, and the gas would be circulating through the connections as it was in the first instance when starting to work under normal gasholder pressure.

Telephonic communication is provided between this station and all intown stations; and it is intended to devise and instal an automatic appliance for the purpose of actuating the pumping plant in accordance with the intown requirements. But, for the time being, I have thought it better that we should get one or two seasons' experience with the present arrangements before entrusting the supply to automatic devices.

The exhausters are of Messrs. Laidlaw's latest type, fitted with three blades, each operating alternately on the inner chamber of the revolving barrel and the usual outer chamber by means of which the capacity of the exhauster is increased, size for size, to the extent of 35 per cent. The exhauster cylinder is 5 feet in diameter by 5 ft. 6 in. long, and is timed to run at a normal speed of 60 revolutions per minute, delivering 750,000 cubic feet of gas per hour through three miles of 48-inch main at a normal pressure of 30 inches at the pumping-station.

The gas-engines are of the "Birmingham" (Grice's) type, with Lamberton's self-starter, timing valve, &c. The gas-engines are of 125-horse power, with a speed of 160 revolutions per minute; and, as before stated, the exhausters are driven direct by means of friction gearing.

Provision has been made in the pumping-station for duplicating the present pumping plant, as it is hoped in the future that the one 48-inch main can be made to carry all the gas likely to be required from the Granton works. As the demand increases, the pressure given by the exhausters will be made to increase likewise. The exhausters are coupled to the system of connections by means of 26-inch diameter disc-valves.

MANUAL OF ELECTRICAL UNDERTAKINGS FOR 1903.

We have just received Vol. VII. of the above-named work, which year by year increases in bulk—the present issue extending to about 1500 pages. The preface to the new volume contains a table showing the aggregate capital of electricity supply companies in shares, debentures, and loans, and the amounts borrowed by municipalities for electrical undertakings for the last seven years, from which we find that in 1896 the total was £61,109,525, whereas it is now £186,158,964. The increase in the past two years has been altogether about £60,000,000. As the main features in the recent history of the electrical industry are the development of tramways, tubes, and so forth, the present "Manual" contains the maps of all the authorized electrical power schemes. A group of fifteen maps shows the main inter-urban electric tramway systems; and there are two "tube" maps—one showing the existing and authorized "tubes," and the other the promotions for the current session. The statistics of the various branches of the electrical industry are brought up to date; and the schedule containing an analysis of the revenue accounts of all electricity supply undertakings, whether under joint-stock or municipal control, is again bound in with the book. As a supplement, there is the coloured diagram showing in graphic form the comparative results of the working of all these undertakings; and, in addition, there is a similar diagram of the working results of all the electric traction undertakings for which the figures are available. This traction diagram is a novel feature. As usual, the "Manual" contains detailed statistical, financial, and engineering information regarding every electrical undertaking in the kingdom, which number close upon 2000. The "Directory of Officials" has been greatly enlarged, and now includes more than 8000 names. A "Buyers' Directory" has been added. Other features in the list of contents are tables showing comparative results, for two to five years, of all electrical undertakings; a list of the highest and lowest prices of electrical investments quoted in the years 1899, 1900, and 1901; a list of all electric tramways and light railways constructed, under construction, authorized, and applied for; and a list of electrical companies registered since 1856. The contents of the volume have been compiled under the direction of Mr. Emile Garcke, and they afford striking evidence of the development that is going on in the world of electricity.

THE ENGINEERING CONFERENCE: QUESTIONS OF GAS ENGINEERING.

The Engineering Conference which has just been held in Westminster, under the auspices of the Institution of Civil Engineers, embraced a great number and variety of subjects of the first importance for engineers, and through them for the community at large. For whatever else may be truly said of the scope of engineering, it is, beyond all rivalry or comparison, the science and art of usefulness to the material world; and the engineer is the man-of-all-work of Civilization. As such, a good deal of what he does and writes about for the edification of himself and his fellows in service is only "shop," and therefore beyond the comprehension not only of the general public who benefit by the results achieved, but also of engineers who specialize in other things. This consideration discloses at once the strength and the weakness of the Institution of Civil Engineers. The strength lies in the success with which the Institution has preserved the allegiance of engineering specialists of all classes; and the weakness consists in the impossibility of a central Institution, though seated in London, providing equally for the needs of all the specialities among which the labours and speculations of members are divided. Hence the necessity for specialized organizations, which offer the departmental engineer the expert and critical environment he needs for the development of his idea upon bases tested by pertinent discussion.

It was a good idea, nevertheless, of the guiding spirits of the one original Institution of Civil Engineers, to hold periodical reunions of its membership, and thus provide the whole engineering world with recurring opportunities of taking stock of their acquirements and purposes. In engineering, however, even more poignantly than in most other branches of human endeavour, the value of any arrangement depends entirely upon how it works. If these Engineering Conferences are to rank as useful audits of achievement and promise, it is necessary that the proceedings should be both comprehensively planned and adequately carried out. This requirement raises, in an extreme degree, the chief object of solicitude of all technical societies, which is the securing of a sufficiency of topical, useful, interesting, and masterly papers for reading and discussion at the meetings. Everybody who has to do with this kind of business knows by painful experience how difficult it always is, how impossible sometimes, to satisfy this demand. Time and again, eager and expectant gatherings have to be offered meagre technical fare, and go away disappointed, because of the lack of satisfactory and suitable intellectual provender. Through dread of such a result, the councils of societies accept such contributions as they can get, not always such as they would like; and they do so often in the hope that the discussion will better the occasion.

This is not infrequently the case; and the effect must in fairness be duly credited to the cause—that is to say, the paper—just as some men's company is esteemed not so much for their own wit as because they are able to evoke the wit of others. Yet it is not always fair to expect one's company to provide their own entertainment, nor does it answer if tried too often. In regard to the ordinary working of a technical society, it may be sufficient to offer, for want of something better, a communication which merely opens for discussion a topic of the day upon which there is likely to be plenty of talk only waiting to be let loose in a congenial assembly. This is quite legitimate, and very useful and enjoyable. It is not, however, a sufficient source of attraction to a conference intended to be important. The Institution of Civil Engineers takes pains to secure the most eminent professional assistance in organizing these functions; and in some respects the results are admirable. Especially is this praise deserved for the excursions and visits to works arranged for these occasions. Object-lessons are of the essence of engineering; and a properly-managed inspection of a representative modern gas-works, for example, is worth a good deal of "paper-chasing."

Of course, we cannot pretend to have any right to express an opinion respecting the quality of the stocktaking effected at the Conference in other departments of engineering knowledge besides that connected with the gas industry. So far as this industry is concerned, however, the opportunity was completely lost. Dr. Rideal was supposed to bring forward the subject of "Coal-Gas Standards;" but he made no pretence of keeping to

his text. Then, it is impossible to take seriously, in an audit of engineering progress, the suggestion of Mr. Beilby for a tax on smoky domestic chimneys. Really, this is a contribution to the great fiscal controversy that might have been reserved for some debating society. The most suggestive paper bearing upon gas engineering problems was that of Mr. Herbert A. Humphrey on the gas-engine; and the discussion brought out some points of much importance in connection with the business of power distribution. The theoretical economics of the gas-engine, regarded as an internal-combustion prime mover, were touched upon in the "James Forrest" lecture of Mr. W. H. Maw, as reported in last week's "JOURNAL," but were not illuminated. It occurs to one that this lecture-room definition of gas-engines as "internal-combustion" motors has not contributed to their improvement. It is even probable that it has operated detrimentally, by directing the attention of engineers of the more studious order to an unfruitful line of investigation. For years, the undeniable wastefulness of the gas-engine, regarded from this standpoint, barred the way to its development as a source of large powers. Nothing has been done to remove the obstacle. While some were boggling over this apparently incurable shortcoming of the "internal-combustion" engine, however, others were simply disregarding it. The developments of the gas-engine in which practical persons are interested are, on the one hand, the large engines rendered possible by the use of the waste gas of blast-furnaces, and, on the other, the very compact engines using petroleum spirit vapour for driving mechanical road-cars and small vessels. In both ways, practical progress has been achieved by neglecting theoretical economy.

Something approximating to a real stock-taking of the position and prospects of the large gas-engine—though not, as we shall soon see, actually realizing this *desideratum*—was the outcome of Mr. Humphrey's paper and the discussion resulting from it. The next thing to be thought of, after the large gas-engine had become an accomplished fact, was the use that could be made of it. Of course, the first makers of big gas-engines to use blast-furnace gas (previously wasted or but little used) for the direct generation of motive power, knew what to do with it. The power was used locally, in the shadow of the blast-furnace itself, for blowing air into the latter. When it came to be a question of using large gas powers for other purposes, the generation of electricity suggested itself; and this led to the proposal to make the big gas-engine independent of the blast-furnace by supplying it with specially made "producer" gas. It was the purpose of the paper to place on record the progress attained in this respect.

It did not, on the face of it, do this. For reasons that need not be stated, the progress made in the utilization of blast-furnace gas for engines is not to the point. Not only does this gas cost nothing, but the engine has to be taken to it. The only true commercial use of big gas-engines, therefore, is that involving the manufacture, for the express purpose, of producer gas. Of the existence of such a use there is no doubt; but Mr. Humphrey has not told us its exact extent. The question is one of great importance, for reasons hinted at by Dr. Kennedy and others. Mr. Michael Longridge is among those who have the impression that big gas-engines using producer gas are, in this country, more often talked about than seen. Dr. Kennedy said—and any remarks coming from him on the subject are of enormous weight—that he had not quite satisfied himself that these large-unit gas powers, with producer gas, are so suitable as steam-engines for central station use. Why is this? Partly, it appears, because these large gas-engines will not drive alternators in parallel. Professor Burstall made this statement; and the most that Mr. Campbell could claim on the other side was that with belt-driving this operation is possible.

Evidently, therefore, the big gas-engine has its mechanical limitations for the central-station electrician. But this is not all. The big gas-engine requires a big gas producer; and here is where the weakness of the combination appears. Mr. Henry Davey, as usual, puts his finger on the weak spot. It is the producer which is the trouble. General Webber acknowledged that this criticism is well founded. He declared that those who run electric lighting stations have no use for such gas-producers as entail the recovery of bye-products. This rules out all such producers as depend for their commercial value on the recovery of these products. Mr. Campbell protested that it is possible to procure producers "in abundance" to work with ordinary coal, gas coke, or anthracite, and they "need not" be accompanied by ammonia-recovery plant. Doubtless, Mr. Irwin, who addressed us on this subject a short time since, would say the same. But the point is, how much in the way of purifying plant, besides residuals recovery plant, is necessary for power-gas producers fed with any fuel other than the cleanest anthracite? Can a town power station do with anything of the kind, and defy the policeman? And there is the question of ground-space to consider. A steam-boiler can be housed in a cellar, or even on a housetop, but not a gas-producer. For ordinary town use, therefore, the latter kind of plant is absolutely impossible. Even for the service of isolated public institutions—such as hospitals and asylums, where there is room for it—the nuisance of a producer burning anything but first-class anthracite is prohibitive. And, of course, when it is a case of keeping a store of, and burning, anthracite costing, as a rule, twice the price of ordinary steam coal or coke, the superiority of gas power so generated loses its prominence in the matter of price.

The facts seem to be susceptible of being boiled down to the following essential truths: We can safely omit from consideration, in this connection, the blast-furnace gas-engine. The big gas-engine is not yet (*pace* Kennedy) the equal for every mechanical application of the steam-engine. Power-gas producers for the supply of big gas-engines are unsuitable for town use. Gas-producers for small-power units must burn anthracite, unless nuisance is not objectionable. The competition for whatever trade there may be in power distributed in towns, is between electricity generated at central stations and ordinary illuminating gas. The lowest price for electric power supplies in any town of the kingdom is 1d. per Board of Trade unit, or $1\frac{1}{3}$ horse-power-hour. The same energy can be derived, regularly and at any time, from the consumption in a small gas-engine of gas costing hardly anywhere above $\frac{1}{2}$d., and generally less. Though it may be difficult to define with precision upon paper what is a small gas-engine and what is a big one, in fact there is no such difficulty; and no user of power up to 50-horse power, or even higher, would think of using a steam-engine, or incurring the trouble of a gas-producer plant, if he was within practicable reach of a supply of illuminating gas at anything under 3s. 6d. per 1000 feet.

If the foregoing statement is true, then the field of real usefulness for big gas-engines working with producer gas is limited, both in respect to locality and applications. If what was in the minds of Dr. Kennedy, Mr. Longridge, and Mr. Henry Davey in this regard, when these experts took part in the discussion of Mr. Humphrey's paper, does not lie within the four corners of our definition of the position, it would be of service to have the discrepancy cleared up. Meanwhile the statement stands.

ANALYSES OF AMMONIACAL LIQUORS.

IN the notice which appears elsewhere of the recently issued annual report of the Chief Inspector under the Alkali, &c., Works Regulation Acts (Mr. R. Forbes Carpenter), reference is incidentally made to some results of analyses of ammoniacal liquors of different constitution emanating from several sources. These analyses are features of Mr. Carpenter's reports, and the results given in the table on next page will no doubt be studied with interest in conjunction with those which have already been published. It appears that during the latter part of 1901 and the earlier months of last year, it became evident that the method for the estimation of sulphur as sulphocyanide was one that needed revision, as several analyses failed to give satisfactory and concordant results, and it was noticed that these failures occurred where sulphocyanide was a prominent sulphur constituent. Mr. Carpenter's assistant (Mr. Linder) devoted much time to a review of previous work on the subject, and to an examination of such methods as could be applied to the complex mixtures such as are to be found in most ammoniacal liquors. He then prepared, at his chief's request, a memorandum setting out the results of his investigation, which is given in full in the report. Mr. Carpenter expresses his indebtedness to Mr. Linder for the skill and zeal with which the difficult problems were handled, and for the satisfactory method arrived at. The following are the principal portions of the memorandum.

After a brief introduction, in which the reasons for undertaking the investigation are concisely set forth, Mr. Linder states that the method employed for the estimation of sulphur present in ammoniacal liquor as sulphocyanide from 1896 to the commencement of last year was based on that described by Mr. S. Dyson, in a paper on "The Examination of the Ammoniacal Liquor of Gas-Works," communicated to the Society of Chemical Industry in 1883, in which the following procedure was advised for the determination of sulphocyanide (thiocyanate):—

> 50 c.c. of the gas liquor are evaporated to complete dryness, and the residue is heated at 100° for three to four hours. . . . The residue is digested with strong alcohol; then rinsed on to a filter, and washed with alcohol. The alcoholic filtrate is evaporated to dryness, water is added, and the insoluble organic matter filtered off. . . . The solution containing the ammonium thiocyanate is precipitated by the addition of sulphurous acid and copper sulphate. The solution is gently warmed; and, after settling, the precipitated cuprous thiocyanate is filtered off. . . . The cuprous thiocyanate is washed into a flask, dissolved in nitric acid, and the liquid boiled for a considerable time. The copper is then precipitated as oxide by the addition of caustic soda.

This procedure was followed in Mr. Carpenter's laboratory as far as the point at which oxidation of the cuprous salt is completed by nitric acid. It was then modified to allow of the volumetric estimation of the copper by the addition of potassic iodide to the solution, freed from nitric acid, either by evaporation to dryness with sulphuric acid, or by the addition of sodium carbonate to alkalinity, followed by the addition of slight excess of acetic acid—the liberated iodine being titrated, after dilution, by $\frac{N}{10}$ thiosulphate with starch indicator. This modified procedure proved much less laborious than the gravimetric method advised by Dyson, without any sacrifice of accuracy.

The somewhat lenthy treatment required to prepare the thiocyanate for precipitation as cuprous salt was objected to at an early stage in the work; but all efforts made to simplify it proved

TABLE *Showing the Constitution of Ammoniacal Liquors.*

Liquor.	Degrees Twaddel.	Cyanide.*	Chloride, Calculated as HCl. per 100 c.c.	Distribution of Sulphur.							Ammonia.				Carbonic Acid.		Sulphuretted Hydrogen.		Total Acids. B + C; H.E.	Difference of Acids. (B + C − A); H.E.	Difference of Acids. (B + C − A) NH_3, H.E. = 100.	Per Cent. of Total Acids as Sulphuretted Hydrogen.
				As Sulphate, Sulphur per Cent.	As Sulphocyanide, Sulphur per Cent.	As Thiosulphate, Sulphur per Cent.	As Polysulphide and other forms by difference, Sulphur per Cent.	As Sulphide, Sulphur per Cent.	Total Sulphur per 100 c.c.	Per Cent. of Sulphur to Ammonia.	Total per 100 c.c.	Fixed per 100 c.c.	Free. Per 100 c.c.	Free. A. H.E.	Per 100 c.c. B. H.E.		Per 100 c.c. H.E. C. H.E.					
Gas-Works—																						
1	3·5	P.	·062	0·92	2·40	4·68	− 1·07	93·07	·2502	17·60	1·421	·085	1·336	78·6	1·661	75·5	·2474	14·6	90·1	+ 11·5	+ 14·6	16·1
2	6·3	T.	·485	2·29	15·79	13·08	− 4·54	73·38	·7398	27·55	2·685	·381	2·304	135·5	2·647	120·3	·5768	33·9	154·2	+ 18·7	+ 13·8	22·0
3	5·8	A.	·821	3·86	30·61	23·13	− 2·69	45·09	·6947	27·58	2·519	·647	1·872	110·2	2·305	104·8	·3329	19·6	124·4	+ 14·2	+ 12·9	15·7
4	6·2	A.	·927	1·03	5·47	1·19		92·31	·5616	19·63	2·860	·510	2·350	138·2	2·492	113·3	·5508	32·4	145·7	+ 7·5	+ 5·4	22·2
5 (*a*) Mar. .	8·5	T.	·194	2·39	15·28	7·50	− 0·45	75·28	·9213	27·82	3·311	·289	3·022	177·8	3·751	170·5	·7370	43·4	213·9	+ 36 1	+ 20·3	20·3
(*b*) Oct. .	6·4	T.	·232	3·54	28·27	14·36	− 5·81	59·64	·5660	21·34	2·652	·289	2·363	139·0	3·177	144·4	·3587	21·1	165·5	+ 26·5	+ 19·1	12·7
6 (*a*) Ap. .	3·0	T.	·431	6 71	36·78	0·89		55·62	·4603	34·92	1·318	·345	0·973	57·2	0·880	40·0	·2720	16·0	56·0	− 1·2	− 2·2	28·6
(*b*) July .	4·8	P.	·100	3·04	9·34	2·61	− 5·39	90·40	·6124	27·50	2·227	·093	2·134	125·5	2·277	103·5	·5882	34·6	138·1	+ 12·6	+ 10·0	25·1
7 (*a*) Store .	3·4	T.	·775	3·25	15·43	29·13	− 15·10	67·29	·2767	19·62	1·411	·433	0·978	57·5	1·089	49·5	·1979	11·6	61·1	+ 3·6	+ 6 3	19·0
(*b*) Washer .	..	..	..	..	..	..	..	..	..	..	6·846	·496	6·350	373·5	7·690	349·5	·4335	25·5	375·0	+ 1·5	+ 0·4	6·8
Coke-Ovens .	3·3	P.	·134	2·78	13·35	29·19	− 18·29	72·97	·1798	14·43	1·246	·098	1·148	67·5	1·672	76·0	·1394	8·2	84·2	+ 16·7	+ 24·7	9·7
Iron-Works .	2·6	A.	·044	71·98	10·99	17·03		Absent	·0182	6·67	0·273	·086	0·187	11·0	0·383	17·3	Absent	..	17·3	+ 6·3	+ 57·3	..

* P. = present; T. = traces; A. = absent. In No. 6 (*a*) liquor alone was ferrocyanide detected.

unsuccessful until recently, when, as already mentioned, discrepancies occurred which imperatively called for investigation. An experimental trial was made of the method recommended by Mr. John T. Sheard, in the paper presented by him at the meeting of the Gas Institute in Belfast in 1898, for estimating sulphocyanide, as preferable, for technical purposes, to Mr. Dyson's plan of evaporating to complete dryness. It was not, however, prolonged, as a more convenient one was devised, and, after extended trial, adopted. The mode of procedure was as follows:—

Boil the solution to expel volatile ammonium salts (sulphide, carbonate, cyanide, &c.), add ferric chloride in amount slightly in excess of that required to complete the precipitation of the ferrocyanide as prussian blue—a point easily recognized by the appearance of the well-known blood-red colour of ferric sulphocyanide in the solution—and filter (the solution may be warmed to promote separation of the prussian blue in the flocculent condition essential for satisfactory filtration), cool, add sulphurous acid in sufficient excess, followed by copper sulphate, and set aside for one to two hours *in the cold* to deposit cuprous sulphocyanide. Filter and wash thoroughly with hot water, using a little potassium or sodium sulphate with the wash water if there is any tendency for the precipitate to pass through the filter-paper. The final washing must remain colourless on the addition of a trace of ammonium sulphide. Wash the cuprous sulphocyanide, which should be white, into a flask; the last traces being removed from the paper by warming on a clock glass with dilute nitric acid (1 : 3), 1 to 2 c.c. of strong nitric acid added, and boil the solution until green. In presence of organic matter, evaporation to dryness and gentle ignition, followed by further treatment with nitric acid, are sometimes required to complete oxidation of the copper; but this is rare. Cool, add slight excess of sodium carbonate, acidify with acetic acid, add potassium iodide, dilute, and titrate the liberated iodine with $\frac{N}{10}$ thiosulphate and starch indicator. 1 c.c. of this thiosulphate = 0·0032 gramme of sulphur as sulphocyanide.

Having established the convenience and accuracy of this method for the estimation of sulphur as sulphocyanide in ammoniacal liquors from which organic matter was absent, it remained to extend its use to the analysis of those of more complex character derived from gas-works, coke-ovens, &c. This has now been done, and the results have proved so concordant as to justify the adoption of the method in place of the evaporation plan of Dyson, which gives too low results.

In order to illustrate the close agreement of duplicate determinations of the same liquor, Mr. Linder gives the following figures of the sulphur as sulphocyanide in grammes per 100 c.c., from actual analyses of works samples:—

Source of Liquor.	Laboratory Method.		Mr. Sheard's Method.
Gas-works—	Exp A.	Exp. B.	
5 (*b*)	0·1600	0·1603	..
6 (*a*)	..	0·1693	0·1745
(*b*)	0·0569	0·0575	..
7 (*a*)	0·0427	0·0427	..
Coke-ovens	0·0240	0·0240	..
Iron-works	0·0020		..

The complete analyses of the ammoniacal liquors from which the above figures are taken will be found in the table. Analyses 1 to 5 (*a*) were made with the old method; those that follow were all by the more approved method just described. In reviewing them, Mr. Linder remarks that it is noteworthy that the figures for "sulphur as polysulphide and other forms" are all preceded by a negative sign; showing that the sum of the sulphurs returned as sulphate, sulphocyanide, thiosulphate, and sulphide exceeds the total sulphur found by bromine oxidation and precipitation as barium sulphate, by a very substantial amount, even in the earlier analyses, where the figure for sulphur as sulphocyanide is undoubtedly low. The meaning of this negative "difference" figure has already been very fully discussed in an earlier report, where the conclusion was reached, and is considered to be justified, that the presence of sulphite is the disturbing factor in such cases—causing the figure for thiosulphate to largely exceed its proper value by reason of the circumstance that the factor of conversion of $\frac{N}{10}$ iodine into sulphur for thiosulphate is four times as great as that for sulphite.

The following figures (being percentages of the total sulphur) will serve to illustrate the disturbing effect of sulphites upon the calculation of thiosulphate, when differentiation is impossible on account of the disturbing action of organic matter:—

Source of Liquor.	Calculated from Iodine Titration.		By Difference Method.
	As Thiosulphate, Sulphite Assumed Absent.	As Sulphite, Thiosulphate Assumed Absent	Thiosulphate *plus* Sulphite.*
Gas-works	14·36	3·59	8·55
5 (*b*)	2·61	0·65	—2·78
6 (*b*)	29·13	7·28	14 03
7 (*a*)	29·19	7·30	10·90
Coke-ovens			

* Including all the errors of experiment.

Mr. Linder says the conclusions reached above are necessarily given with reserve, as prolonged study of the analysis and constitution of ammoniacal liquors impresses upon the mind the difficulty of determining the exact quantitative relationship of the various constituents of these complex mixtures; and the application to them of more perfect methods of analysis than those hitherto devised may yield results which will lead to somewhat different conclusions.

Incandescent Gas Lighting for Churches.—Mr. J. H. Troughton, the Engineer and Secretary of the Newmarket Gas Company, is determined that the inhabitants of the town shall not be kept uninformed as to the saving to be effected by the use of incandescent gas-burners. He has therefore utilized the advertisement columns of a local paper for setting forth the advantages of this system, from a monetary point of view, as strikingly exemplified at All Saints' Church. This building was lighted by flat-flame burners in the quarter ending March 31, 1902, at a cost of £12 17s. 3d.; the quantity of gas used being 68,100 cubic feet. In the corresponding quarter this year, only 11,600 cubic feet of gas were required with the installation of incandescent gas-burners, at a cost of £2 10s. 1d.; being a saving of £10 7s. 2d., or 80 per cent., besides furnishing twice the light.

FROM SIDING TO COKE-STORE AT THE BURY GAS-WORKS.

Cost of Labour with Machine-Worked Horizontal Retorts—Low Net Cost of Gas into the Holders.

THERE were four of us crowded on the small space forming the footboard of the little locomotive bearing the name of "Elton." The party comprised the Engineer and Manager of the Bury Corporation Gas-Works (Mr. Henry Simmonds), the engine-driver and his mate, and the writer (a member of the "JOURNAL" staff). The "Elton" is a smart, 12-inch cylinder engine, and is one of two possessed by the Bury Corporation Gas Department for negotiating the goods traffic to and from their works. She was standing at the time we boarded her on the Corporation private sidings at Deardens leading from the Lancashire and Yorkshire Railway; and the object in view was to travel by the engine, with two trucks of coal coupled up behind, to the point of the delivery of the coal on the works, see the coal deposited into underground hoppers, elevated and conveyed into store, carried from there to the hoppers in the retort-house, transferred to the West compressed-air charging-machines, and finally deposited in the retorts for carbonizing; and beyond to witness the manner of dealing with the spent charges. And why?

In December last year, Mr. John West set himself to show the fallacy of the idea that power charging and drawing machinery could not be worked economically in medium-sized works. He quoted Bury as an example. Working with the compressed-air charging and drawing machines on twelve beds, he said that Mr. Simmonds was doing the drawing, charging, and coke-conveying for 1s. 1½d. per ton of coal carbonized; and this sum included the whole of the labour for bringing the coal into the coal-store and retort-house, the machine men and attendants, furnace men, and storing the coke in the yard. This statement and further particulars affecting it appear in the "JOURNAL" for Dec. 16 last. The accuracy of the figures were in a measure challenged; and Mr. West soon found himself involved in a little controversy as to how the figures he had adduced compared with inclined retort working. However, a large amount of interest was evinced over the figures that Mr. West gave for Bury, and further information was desired. The discussion came to a somewhat abrupt termination for the time, as the additional particulars were not forthcoming. The reason for this was that Mr. Simmonds considered the best course would be for a representative of the "JOURNAL" to visit Bury, see the methods of working for himself, and make whatever independent investigation he liked into the question at issue, and publish the result. The publication has been a little delayed, in order that the complete weekly figures for the financial year ending March 31 might be included. This preliminary explanation may end with two requests. The first is that the whole article shall be read, and the points taken into consideration collectively, before subjecting any one of them to criticism. The second is that readers will not

FIG. 1.—THE PRIVATE RAILWAY SIDINGS OF THE BURY CORPORATION GAS DEPARTMENT AT DEARDENS.

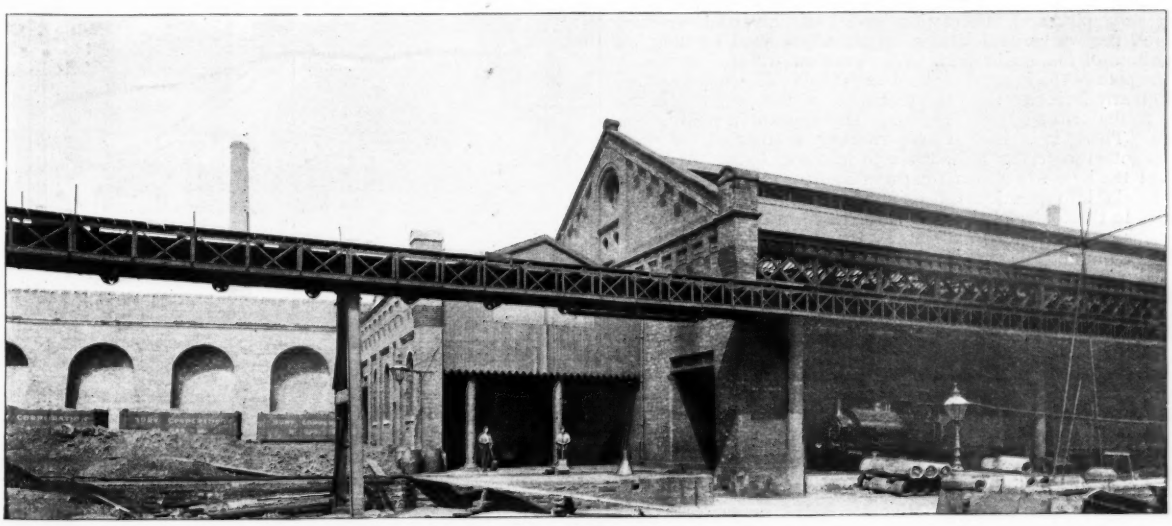


FIG. 2.—THE SHED IN THE CENTRE OF THE VIEW IS WHERE THE COAL IS TIPPED INTO THE LARGE HOPPER AND BREAKER FROM THE RAILWAY TRUCKS. THE COAL-SHED IS ON THE RIGHT-HAND SIDE.

(One of the Cross Conveyors for Stacking Coke in the Top Yard is also shown—Marked E on Plan.)

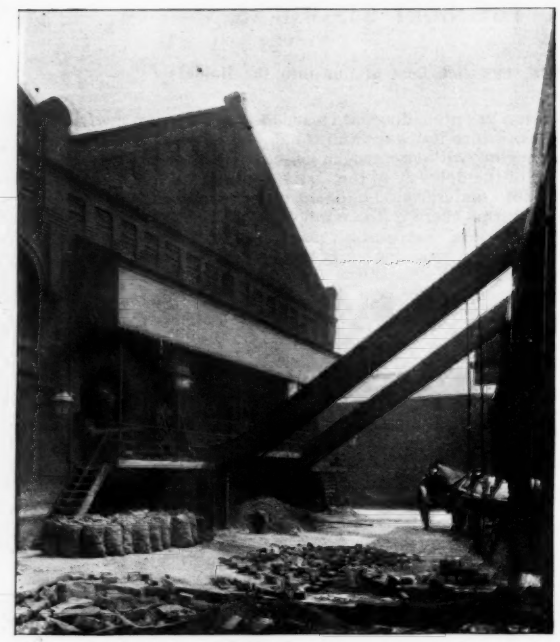


FIG. 3.—END OF NO. 2 RETORT-HOUSE, SHOWING INCLINED QUENCHING SHOOTS OF THE DE BROUWER COKE-CONVEYORS.

(The Inclined Conveyors lead to the Coke Storage Hoppers and Cross Conveyors.)

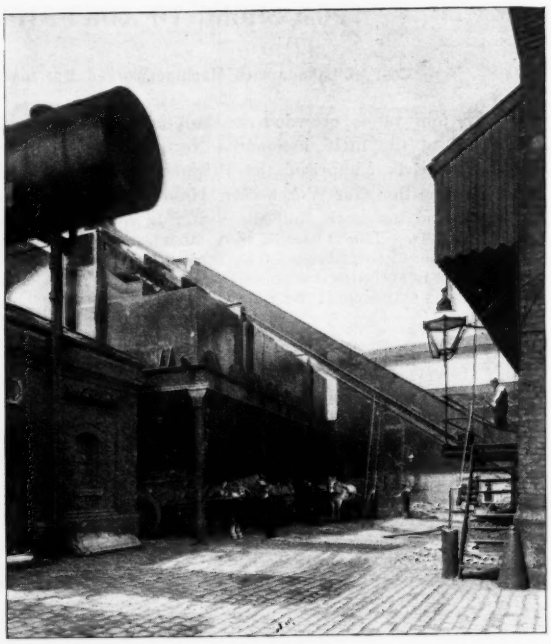


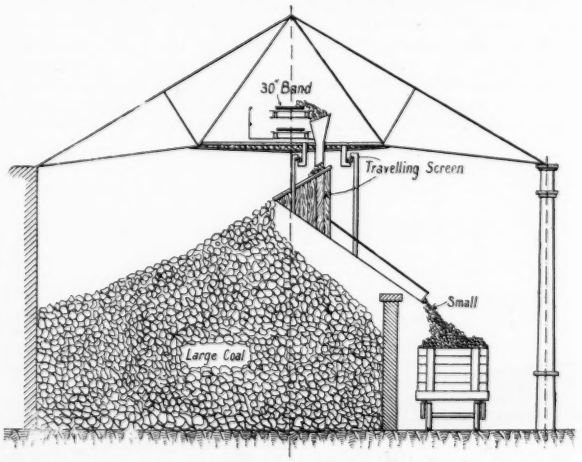
FIG 4.—THE COKE STORAGE HOPPERS AND CROSS CONVEYOR, FED BY THE INCLINED DE BROUWER CONVEYORS.

(The Hopper in the Distance has just been completed for the Coke from No. 2 House.)

regard this as a journalistic attack on the inclined retort system. It is (strange as it may seem to many) necessary to point this out, as there are a few people who fail to comprehend that the duty of a journalist is to hear all sides, and to deal honestly and disinterestedly with the information.

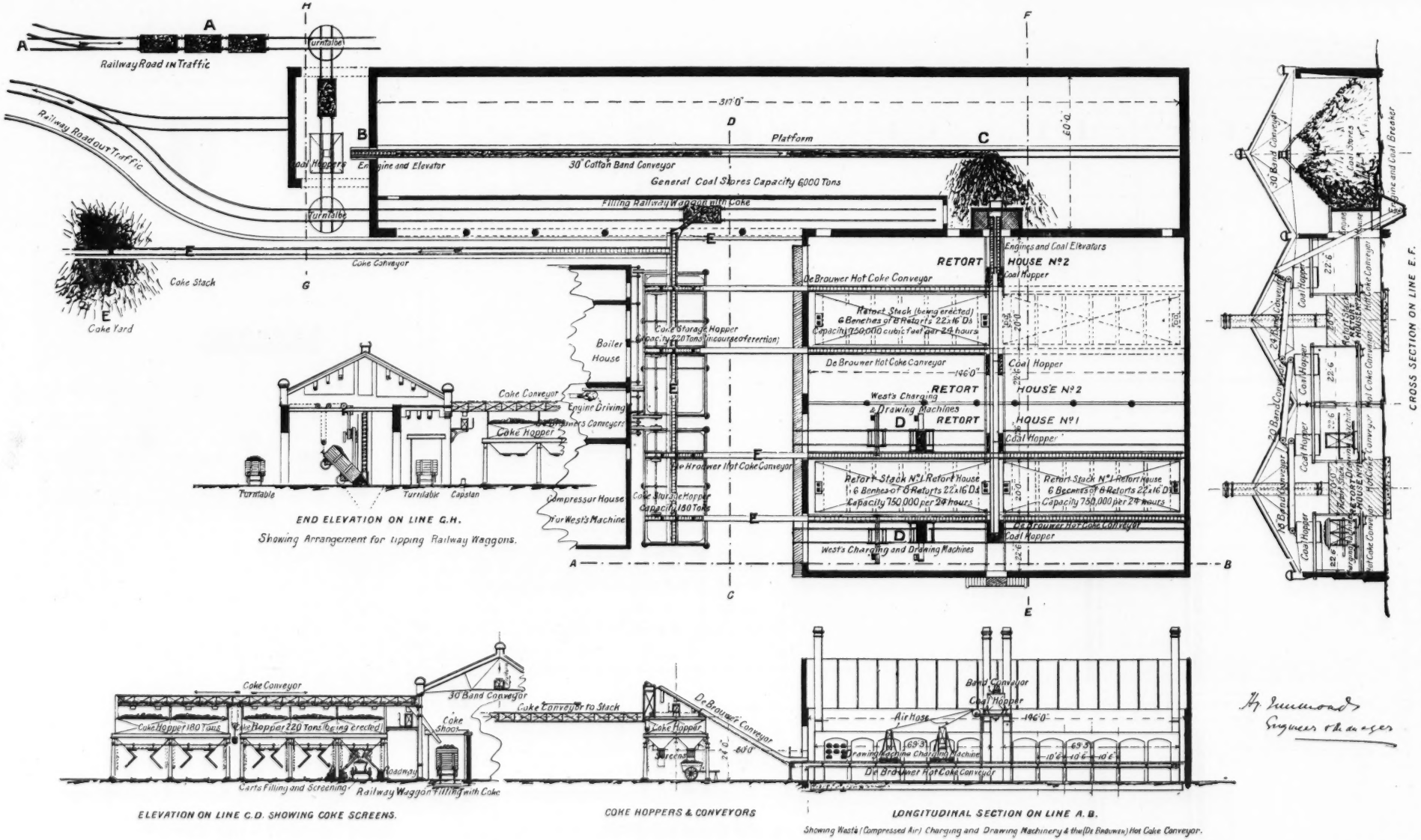
However, we were on the footboard of the locomotive "Elton" at the end of the Corporation private sidings at Deardens; and the driver's mate has just coupled up two truck-loads of coal for transmission to the gas-works. A photographic view of the spot is given (fig. 1); and the large shaft in it marks the position of the Corporation tar-distillery. The sidings connect up with the main line between Liverpool and the Yorkshire district; and from the point of connection to the gas-works is about ½ mile. The trucks coupled up to the locomotive are drawn over an ordinary weigh-bridge and weighed; and, as we are standing there, it is remarked that the machine was made by Samuel Dennison and Sons, of Leeds. As we pass along the ½ mile of line, through the cutting and a tunnel under the Bolton Road and certain private property, Mr. Simmonds gives the information that the sidings cost some £40,000, and are equal to dealing with a considerable amount of traffic—something like 50,000 to 60,000 tons per annum. By the sidings, the whole of the other gas-works goods are also dealt with; and on them a claim of 4d. per ton is made—this including the siding and terminal dues. By the time that these and other interesting pieces of information have been imparted, we have entered the works, and drawn up outside a shed forming an extension of the coal-stores. The position will be seen at A on the plan of the general carbonizing plant—reference to which will greatly facilitate the comprehension of the progress of the coal to the retort-house. The shed also appears in photograph fig. 2. There is a line of rails running in front of the shed, and another entering from the side into the back. At either end of the house is a steam-capstan and turn-table for hauling the trucks into position for emptying or running out of the shed. In the centre of the floor is the large receiving hopper, B, which has a capacity of about 15 tons. Our two trucks are brought in, and one after the other turned lengthwise and placed over the hopper, elevated from their outer ends by chain-gearing worked from the main driving steam-engine (a 20-horse power one) in the basement below, and the contents discharged into the hopper. As emptied, each is dragged by the capstan on to the turntable at the opposite end of the house, and turned and sent on to the outgoing line ready for dispatch or filling with coke. Only one man and a boy are engaged in this work of tipping; and from the time each waggon was taken in hand to its exit from the shed, careful observation showed that only fifteen minutes had been absorbed. Under these conditions, with only a man and boy engaged, some 300 tons of coal a day can be easily dealt with. To this point, since Deardens was left the only labour employed has been the locomotive driver and his mate, and the man and boy in the waggon-tipping shed. Consulting the table of wages for last year (p. 955), it is seen that labour in the traction work cost (taking the whole year) an average of 1·16d. per ton of coal carbonized; and for the work in the tipping-shed 0·90d. per ton—together 2·06d. per ton.

Following the coal on its course from the hopper, it passes through a large crab coal-breaker; and this feeds into the boot of a bucket elevator—this being of a capacity of some 40 tons per hour. It is observed here that the simple plant dealing with the coal is of the type made by the West Gas Improvement Company some few years since; and inquiry informs us that it has been at work now for some seven years. The elevator feeds on to a 30-inch cotton band conveyor running the full length of the coal-store, which is about 317 feet long, and has a capacity of 6000 tons. (Along the retort-house side of the store is a line of rails and provision for filling with coke the empty coal-trucks, as will hereafter be explained.) From the band conveyor, it is remarked that the coal can be thrown off at any convenient place. For stacking purposes only, the larger lumps are used; the small being separated from it by a travelling screen (as seen in the



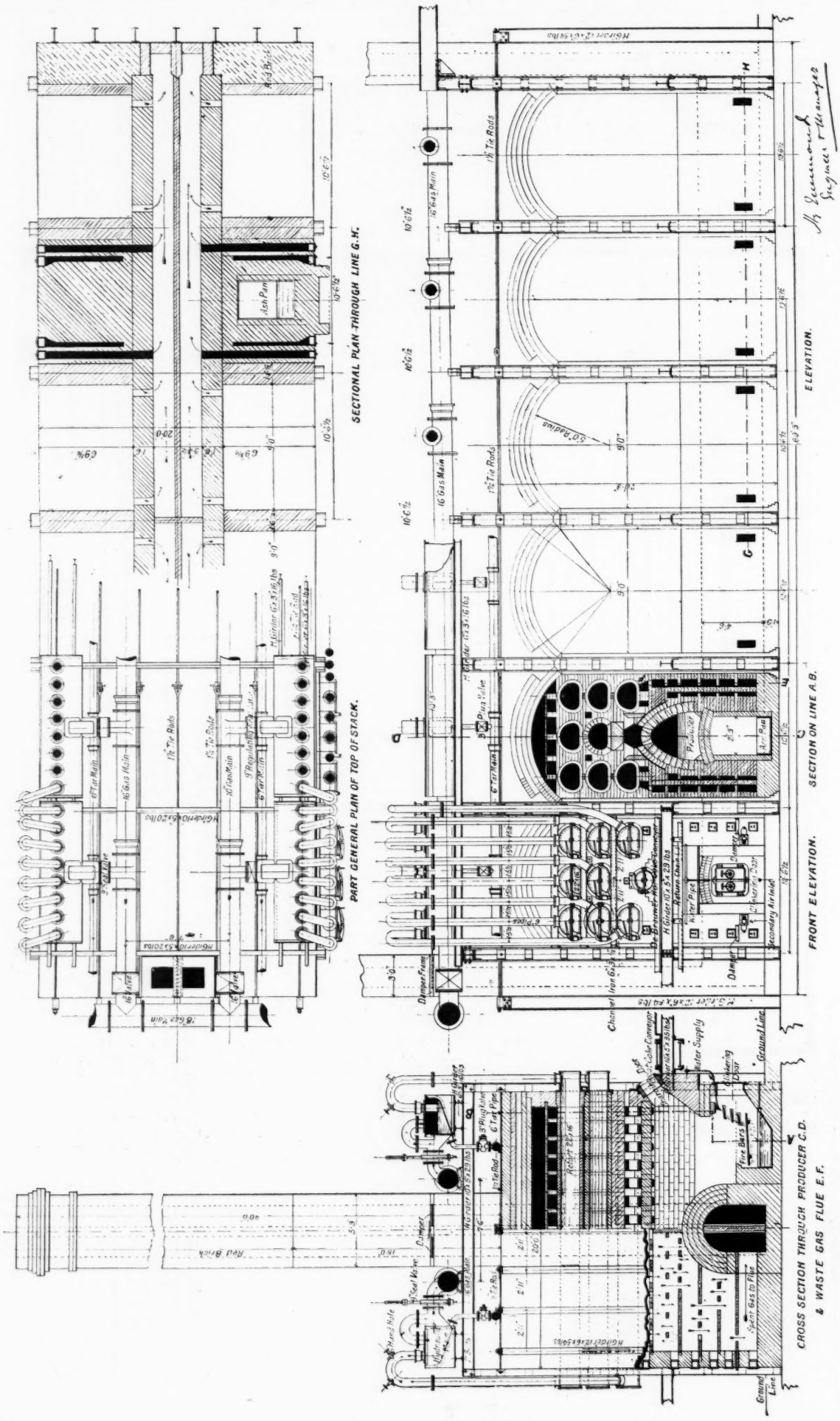
CROSS SECTION THROUGH COAL-STORE, SHOWING SCREENING ARRANGEMENT.

accompanying sketch). The coal which has been stacked in the way described, Mr. Simmonds tells us, has shown no signs of firing. The supply for immediate use is tipped off the band conveyor at the point marked C in the plan. Here is situated a second set of coal-breakers (in duplicate). The coal is broken small, elevated into the retort-houses, deposited on transverse belt conveyors, and carried to any one of the overhead hoppers for feeding the charging machines as desired. All this work was accomplished as we watched; and this forms a good point to stop for further inquiry as to cost. Looking up the table of wages paid last year for coal elevating right away to the hoppers, it will be seen that the average cost per ton was 1·96d.


Railway Road in Traffic
Railway Road out Traffic
Turntable
Coal Hoppers
Engine and Elevator
30" Cotton Band Conveyor
General Coal Stores Capacity 6000 Tons
Filling Railway Waggon with Coke
Platform
317'0"
60'0"
Coke Conveyor
Coke Stack
Coke Yard
Boiler House
Coke Storage Hopper Capacity 220 Tons (in course of erection)
Retort Stack (being erected) 6 Benches of 8 Retorts 22"x16" Ds Capacity 750,000 cubic feet per 24 hours
De Brouwer Hot Coke Conveyor
Engines and Coal Elevators
RETORT HOUSE No 2
Coal Hopper
146'0"
West's Charging & Drawing Machines
RETORT HOUSE No 1
Engine Driving
Coke Hopper
Retort Stack No 1 Retort House 6 Benches of 8 Retorts 22"x16" Ds Capacity 750,000 per 24 hours
Compressor House for West's Machine
Coke Storage Hopper Capacity 180 Tons
Turntable
Capstan
END ELEVATION ON LINE G.H.
Showing Arrangement for tipping Railway Waggons.
CROSS SECTION ON LINE E.F.
Showing West's Compressed Air Charging and Drawing Machinery.
Coke Hopper 180 Tons
Coke Hopper 220 Tons (being erected)
30' Band Conveyor
Coke Conveyor to Stack
Coke Shoot
Roadway
Carts Filling and Screening
Railway Waggon Filling with Coke
ELEVATION ON LINE C.D. SHOWING COKE SCREENS.
De Brouwer Conveyor
Screens
COKE HOPPERS & CONVEYORS
Band Conveyor
Air Hose
Drawing Machine
Charging Machine
LONGITUDINAL SECTION ON LINE A.B.
Showing West's (Compressed Air) Charging and Drawing Machinery & the (De Brouwer) Hot Coke Conveyor.

H. Simmonds
Engineer & Manager

BURY CORPORATION GAS-WORKS—PLAN OF THE CARBONIZING PLANT. FROM THE RAILWAY SIDING TO THE COKE STACK.


SECTIONAL PLAN THROUGH LINE G.H.
PART GENERAL PLAN OF TOP OF STACK.
ELEVATION.
FRONT ELEVATION.
SECTION ON LINE A.B.
CROSS SECTION THROUGH PRODUCER C.D.
& WASTE GAS FLUE E.F.

BURY CORPORATION GAS-WORKS—NEW BENCH OF SIX THROUGH SETTINGS IN NO. 1 RETORT-HOUSE.

BURY CORPORATION GAS-WORKS.—CARBONIZING PLANT IN RETORT-HOUSE No. 1.

Table showing the Coal Carbonized, the Number of Men Employed (a), and the Weekly Wages Paid (b), for the Year ending March 31, 1903.

Date. Week Ending.	Coals Carbonized.	A — Loco. Driver and Mate.		B — Railway Waggon, Tipping and Elevating.		C — Coal Elevating from Coal-Stores.		D — Charging and Drawing Machinery.		E — Coke Conveying and Storing.		F — Furnaces.		Number of Beds Charged.
	Tons Cwt	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	
April 3	230 0	2	£2 0 0	2	£1 3 9	3	£2 12 6	12	£11 16 2	3	£2 2 0	3	£2 18 1	8
10	575 0	2	3 5 10	2	2 11 5	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	8
17	596 0	2	3 3 6	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	8
24	500 0	2	2 19 4	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	7
May 1	468 0	2	2 16 0	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	7
8	476 0	2	3 3 6	2	2 6 7	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	7
15	476 0	2	3 5 6	2	2 11 5	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	6
22	476 0	2	3 2 4	2	2 8 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	6
29	392 0	2	1 12 5	2	1 5 8	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
June 5	323 0	2	3 8 6	2	2 2 7	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
12	392 0	2	2 19 0	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
19	379 0	2	3 6 6	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
26	373 0	2	2 18 4	2	2 6 7	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
July 3	389 0	2	2 15 11	2	2 3 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
10	383 0	2	2 19 0	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
17	376 0	2	3 1 5	2	2 6 7	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
24	388 0	2	3 4 6	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
31	409 0	2	3 0 10	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
Aug. 7	394 0	2	3 1 0	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
14	393 0	2	1 9 7	2	1 2 3	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
21	385 0	2	3 2 8	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	5
28	448 0	2	2 18 5	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	6
Sept. 4	526 0	2	3 2 4	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	6
11	459 0	2	3 5 10	2	2 6 1	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	7
18	608 0	2	2 15 2	2	2 8 5	3	5 5 0	12	23 12 4	3	4 4 4	3	5 16 3	7
25	564 0	2	2 18 8	2	2 6 7	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	7
Oct. 2	582 0	2	3 2 4	2	2 7 6	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	7
9	628 0	2	3 0 11	2	3 5 3	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	8
16	890 0	2	3 15 0	2	2 15 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	10
23	814 0	2	3 1 6	2	2 7 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	10
30	811 0	2	3 9 6	2	2 7 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	10
Nov. 6	826 4	2	3 11 3	2	2 15 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
13	934 6	2	3 8 8	2	2 8 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
20	930 0	2	3 10 0	2	2 13 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
27	913 14	2	3 6 7	2	2 9 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
Dec. 4	913 0	2	3 8 1	2	2 17 4	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
11	889 0	2	3 12 7	2	2 8 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
18	918 8	2	3 8 8	2	2 11 5	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
25	909 0	2	2 17 7	2	2 8 1	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
Jan. 1	908 16	2	2 19 4	2	2 4 11	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
8	916 8	2	2 11 11	2	1 15 8	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
15	921 0	2	3 0 2	2	2 14 7	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
22	929 14	2	3 3 2	2	2 12 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
29	920 8	2	3 5 10	2	2 12 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
Feb. 5	903 6	2	3 6 2	2	2 12 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
12	856 18	2	3 7 0	2	2 12 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	12
19	874 0	2	3 7 1	2	2 12 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	11
26	852 0	2	3 3 4	2	2 11 6	3	5 5 0	18	35 8 6	3	4 4 0	3	5 16 3	11
Mar. 5	834 0	2	3 5 11	2	2 11 6	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	11
12	748 0	2	2 19 4	2	2 11 6	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	10
19	716 0	2	3 9 1	2	2 13 7	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	9
26	706 0	2	3 1 11	2	2 10 6	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	9
31	443 0	2	3 6 2	2	2 7 5	3	5 5 0	12	23 12 4	3	4 4 0	3	5 16 3	8
Total	33,776 2	..	£163 13 6	..	£126 19 3	..	£275 12 6	..	£1387 17 0	..	£221 7 6	..	£305 3 1	..

Wages per Ton of Coal Carbonized.

A.—Loco. man and mate	£163 13 6	=	1·16d.	C.—Coal elevating to hoppers	£275 12 6	=	1·96d.
B.—Waggon tipping	126 19 3	=	0·90	D.—Charging and drawing machines	1387 17 0	=	9·86
				E.—Coke plant	221 7 6	=	1·57
				F.—Furnaces	305 3 1	=	2·16
Total			2·06d.	Total			15·55d.

Gas made, 363,092,000 cubic feet; do., per ton, 10,750 cubic feet; coke sold, 16,880 tons; do., per ton, 10 cwt.

Entering No. 2 retort-house, interest is diverted for a moment from the main object of the visit by finding that the old direct-fired retort-benches have recently been pulled out; and regenerator settings are being constructed in their stead. About this work, there will be more to be said presently. A hasty glance at the building operations, and we pass to No. 1 retort-house, into the overhead hoppers of which the coal which we have so far followed has been deposited. It is seen that the house (which is a stage-floor one) contains twelve beds of eight 20-feet through retorts, 22 in. by 16 in., set three in each outer tier and two in the centre. The charges at the time were 3½ cwt.; and their duration six hours. The retorts, as previously mentioned, are charged and drawn by West's compressed-air machinery, D; the charging-machines being fed from one centrally situated hopper on each side of the bench. These machines have been doing duty now, it is gathered, for some five years, and are found to be working with splendid ease and regularity. Now on each side of the bench are found three men—one on each machine and a lid man*; and these work on eight-hour shifts. The drawing and charging of the outsides of the second line of retorts—24 in all—is next witnessed, with the excellent result that from the opening of the first lid to the snapping to of the last lid of the 24 retorts—drawing, charging, and all incidental work included—only nineteen minutes were occupied. This is smart work; and Mr. Simmonds must be complimented on possessing men who discharge their duties in the business-like manner witnessed in the case of this gang.

Now here we may give in tabular form, from the actual working last year, the average weight of coal per week put into the retorts by the machines, and the number of stokers required according to the number of beds in operation:—

Number of Beds.		Tons of Coal Carbonized per Week.		Stokers Eight-Hour Shifts.
12	..	925	..	6
11	..	848	..	6
10	..	771	..	6
9	..	694	..	6
8	..	617	..	4
7	..	540	..	4
6	..	463	..	4
5	..	386	..	4

Consulting the large table again, it will be seen that the average cost in wages for charging and drawing last year worked out to 9·86d. per ton of coal carbonized; and for the furnace men to 2·16d. The wear and tear on the charging and drawing machines in the past two years equalled £128 per annum; this including

* This man is not included in sheet of wages above, as he is only employed on the day shift, and then merely when twelve beds are working.

everything that has been done to keep the machines, the compressors, and the hose-piping in good order.

To complete the carbonizing work, we have to follow the course of the coke. The spent charges are drawn out on to De Brouwer conveyors, E, which run along either side of the bench. The coke is transmitted to the end of the house; and then passes up the inclines for delivery either to overhead hoppers or to cross conveyors, as seen in figs. 3 and 4. It is explained by Mr. Simmonds that he has had the inclined part of the conveyors boxed in, as this is where the quenching of the hot coke takes place; and he finds that the box-shoot has had the double advantage of keeping the yard free from steam, and giving the coke a good colour, as well as keeping it hard. When the coke is delivered on to the cross conveyors, it can be sent either into railway waggons on the line alongside the retort-house to which reference has been previously made, or it can be diverted on to a second conveyor, and taken to the top yard for stacking purposes. This conveyor is seen in fig. 2. Regarding the coke-hoppers, it should be mentioned that at each outlet, a screen is fixed; and the coke passing over this is thoroughly freed from all dirt and small before being delivered into the carts. It was elicited from Mr. Simmonds that the De Brouwer conveyors were fully set to work in August, 1901; and so far no repairs have been required. The chains, however, it was remarked, now show signs of soon reaching the limit of their safe span of working life; but, taking the life of the chains at two years, the cost per annum for repairs on the original outlay would be only 8⅓ per cent. Turning once more to the large table, we find that the average cost for wages on the coke plant last year—three men being the number employed—was 1·57d. per ton of coal carbonized.

Now taking the whole of the charges for labour from the coal-elevating plant to the delivery of the coke into carts, railway waggons, or the top yard, we arrive at the total cost for the entire year—not for any one part, which may be more favourable or worse than another—and it is 1s. 3·55d. per ton of coal carbonized. The gas made during the year was 363,092,000 cubic feet, and per ton of coal 10,750 cubic feet. The coke sold was 16,880 tons, which equalled 10 cwt. per ton of coal carbonized. These figures need not be enlarged upon here, as anyone wishing to find the cost at any part of the year, or the highest and lowest costs, can do so from the full statement prepared from the wages books of the department for last year; and if anyone desires to compare for publication his inclined working with the machine-worked horizontals at Bury, it must be done, to receive any recognition by the profession, with the same fulness as here.

We have been the round of the operations with Mr. Simmonds, and have dealt with nothing but the actual labour involved in the carbonizing operations. But it will be of interest to go further to show the ultimate excellence of the working at Bury. Our guide was rather reticent when the conversation drifted beyond the main purpose of the visit. But success rewarded perseverance. It was learnt that Mr. Simmonds prefers doing with local men all the building connected with the retort-settings. Those seen were partly on the Klönne principle, and partly of his own design. In the construction of the regenerators, he says, the chief thing is to keep the gases tight, so that there is no short-circuiting. As was observed, he gets splendid heats throughout the settings; and there, he very properly holds, is where the whole of the efficient and successful working starts. With these splendid heats, he is able to get the maximum results out of both settings and men under the conditions to which he is compelled to work. Now what are those results? He is to-day putting gas of between 19 and 20 candle power into his holders at a net cost of about 7½d. per 1000 cubic feet; and he is selling gas to his consumers at 1s. 9d. per 1000 cubic feet for motive power and at 1s. 11d. for lighting. As to the illuminating power, the Gas Examiner in his report for last year states that the highest of 52 tests was 20·28 candles, and the lowest 17 candles, with an average of 19·69 candles. The bisulphide of carbon is equal to 9·3 grains per 100 cubic feet. After the carbonization of the coal, the rule of the Engineer at Bury is to keep a close personal watch on the residuals, in order to get out of them the utmost per ton of coal carbonized. He deals with his coke so as to obtain the maximum amount of heat from the minimum amount of fuel; of sulphate he gets 30 lbs. per ton of coal carbonized; and with tar the best is done by the Corporation running their own tar distillery. The gross cost of gas last year per 1000 cubic feet was 1s. 7¾·40d.; and the residuals produced 1s. 0¼·12d. Thus the net cost of gas into the holders was 7½·28d. per 1000 cubic feet. Lest we should be challenged on this head, Mr. Simmonds has kindly set out the figures in the preceding table.

Cost of Gas per Ton of Coal Carbonized, and per 1000 Cubic Feet Sold for the Year ending March 31, 1903.

—	Per Ton of Coal Carbonized.	Per 1000 Cubic Feet Sold.
	s. d.	s. d.
Carbonizing—Coal, benzol, siding expenses, stokers, coke, firemen, enginemen, exhauster men, boiler men, foremen, retort-house tools, oils, tallow, repairs to stoking machinery, fire-clay goods, retort setters, &c.	12 9·64	1 3¼·31
Purifying—Oxide and lime and wages	0 5·21	0 0½·09
Yard—Materials and wages	0 11·12	0 1 ·46
Permanent Works—Material and wages	1 6·39	0 1¾·33
Tar Distillery—Material and wages	0 3·16	0 0¼ 26
Sulphate Work—Material and wages	0 7·38	0 0½·94
Gross cost of gas	16 6·90	1 7¾·40
By residuals	10 3·10	1 0¼·12
Net cost of gas in holders	6 3·82	0 7½·28

This ends the particulars which are the outcome of the visit paid to Bury for the express purpose of seeing for ourselves Mr. Simmonds's methods of working, and to obtain from him additional information for the satisfaction of correspondents. But we shall render the information more complete by briefly describing and giving the costs connected with some of the new work he has at the present time under construction. It is intended to convert as required the interior of No. 2 retort-house to exactly correspond with No. 1. The success of the latter is an abundant justification. At the present time, the first half of the house is being dealt with. On the ground there have stood for some 25 years six direct-fired through beds of sixes; and these were charged and drawn by West's manual machines. These old beds are being replaced by six beds of 20 ft. by 22 in. by 16 in. retorts, eight in a setting; and these, when finished, will measure 69 ft. 3 in. long by 20 ft. through by 20 ft. 3 in. from the ground-line to the top of the stack. The building work is being done by Mr. James Byron, of Bury, and the ironwork by Messrs. Clapham Bros. The total cost of the work, completed ready for the manufacture of gas, will be £3729. It will be capable, with six-hour charges, to carbonize some 70 to 75 tons per day; so that the cost will be about £50 per ton. The total cost and the cost per mouthpiece under the tenders are as follows:—

—	Total Cost.	Cost per Mouthpiece.
Walls, arches, main flues, and chimneys	£681 10 3	£7·09
Internal work, including regenerators, retorts, all silica, glenboig, and ganister specials, fire-bricks, clay, and labour	1302 0 0	13·56
Ironwork, including retort-fittings, mouthpieces, ascension-pipes, valves, hydraulic, gas, and tar mains, buckstays and tie-rods, cross girders, furnace ironwork, &c.	1454 0 0	15·14
Stage-floor, including H-girders, rails, floor-plates, and concrete	292 0 0	3·04
Total cost	£3729 10 3	£38·83

The work in hand inside the house is fully explained by the drawing, The De Brouwer coke conveying plant in this house will be installed as in No. 1 house; and, of course, Messrs. W. J. Jenkins and Co. will supply this. In connection with it, the coke storage hoppers will have to be extended; and the contract for this has been secured by Messrs. W. C. Holmes and Co. The hopper when completed will measure 56 feet long by 23 feet wide and 7 feet deep at the vertical sides, with cones 5 feet deep, giving a total depth of 12 feet. The hopper will have twelve outlets for coke, each fitted with the necessary sliding-door, operating levers, brackets, pulley, and chains. The hopper is to be supported on a framework of steel girders, securely bolted together, and carried on eight cast-iron columns.

This completes the story of the visit, and the account of the information gained. It shows the lines along which Mr. Simmonds works, which result in low labour costs per ton of coal carbonized, and cheap gas into the holders and at the consumers' meters. While complimenting him upon all that was seen from the time we together boarded the locomotive "Elton," the writer must thank him too for his courteous attention, for the trouble to which he went in extracting the necessary figures, and for the interesting drawings and photographs since forwarded for illustrating this article.

A Water-Tower Coke-Quencher.—In the notice of the proceedings at the recent congress of the Société Technique which appeared in the "JOURNAL" on the 19th ult., incidental reference was made to an arrangement devised by M. Sar, of Montpellier, for quenching coke. It consists of a light iron framework about 10 feet high, having on the top a water-tank, capable of holding from 18 to 22 gallons, connected with the water service, and fitted with a discharge-pipe. This descends for a certain distance, and then branches off at right angles. One end of this portion of the pipe has upon it a square rose, and the other a counterbalance-weight. A special joint allows of this portion of the pipe being turned up when not in use. The coke-barrows having been run on to a metal plate fixed in the ground in front of the frame-work, the wheeler simply pulls the chain controlling the plug of the tank. The weight of the descending water causes the pipe to take the horizontal position, and the water issues from the rose in a number of jets, which quench the incandescent coke. As soon as the tank is empty, the pipe rises automatically, the tank is filled, and the quencher is again ready for use.

INTERNATIONAL PHOTOMETRY COMMITTEE AT ZURICH.

FROM OUR SPECIAL CORRESPONDENT.

(*Continued from p.* 887.)

IN continuation of my *résumé* of the proceedings of the Committee, they met on Saturday, the 20th inst., at the Hotel Bellevue, Zurich, at 9.30 a.m., and the President at once called upon Dr. H. Bunte to read a paper which he had prepared on the "Technical Standards of Light." In view of the great importance of this communication, both in regard to the immense value which attaches to the establishment of a trustworthy ratio between the various national standards of light and to the great care with which the data had been collected, I send the following full translation of it:—

TECHNICAL STANDARDS OF LIGHT.

The scheme of work for the International Photometric Committee comprised under Heading No. 2 the subject of "A Comparative Statement of the Illuminating Values, as Determined up to the Present Time, of the Various Standards of Light in Use in Technical Work, and of the Methods by which these Values have been ascertained." The following standards in technical use have to be considered. (1) The Hefner lamp, (2) the English sperm candle, (3) the one-candle pentane wick lamp, (4) the German Association paraffin candle, (5) the ten-candle pentane air-gas lamp of Vernon Harcourt, and (6) the Carcel lamp.

Without going more fully into the frequently discussed faults of each of these standards, it must be admitted that at present the Hefner lamp (HK—Hefnerkerze, or Hefner "candle") is the most definitely established unit of light. In course of years, the Hefner lamp has found more and more general acceptance as the standard of light in ever-widening circles in the lighting industries and scientific laboratories. If, therefore, it is desired to select from among the present standards of light one to serve as a basis, the Hefner unit clearly commends itself for the purpose at the outset.

Starting from this point, it would be desirable to have a review of the relations which subsist between the standards of light in use; and this is given in Table I. This table includes, in addition to the above-named widely-known standards of light, some others which are of interest. Among these are the Munich

TABLE I.—*Résumé of Comparative Measurements of Standards of Light.**

[The roman figures are the results of measurements or their reciprocals.]

—		Hefner Units.	German Candles.	Munich Candles.	English Candles.	Harcourt's 1-Candle Pentane Wick Lamp.	Harcourt's Pentane Air-Gas Lamps.		Ether-Benzol Standard.	Carcels.	Violles (Units).	Pyr (*Bougies décimales*).
							1 candle.	10 candle.				
Hefner Units ..	German Measurem'ts	1	0·833 (*a*)	..	0·877 (*b*)	0·85 (*c*)	..	..	*0·60*	*0·092*	*0·044*	*0·89*
	Dutch ,,		..	..	0·9213 (*k*)	..	..	..	..	*0·096* (*k*)	..	..
	Laporte		..	..	..	..	..	..	..	0·092 (*o*)	..	..
German Association's Candles .	German Measurem'ts	1·20 (*a*)	..	..	*1·05*	*1·03*	..	..	*0·72*	*0·110*	*0·054*	*1·07*
	Schilling	..	1	0·887 (*l*)	0·977 (*l*)	..	..	..	..	0·102 (*l*)	..	..
	Monnier	..		..	..	..	..	..	..	0·133 (*h*)	..	..
Munich Candle (stearine) . .	Schilling	*1·35*	1·128 (*l*)	1	1·102 (*l*)	..	..	..	..	0·115 (*l*)	..	..
	Monnier	..	..		..	..	..	..	..	0·154 (*h*)	..	..
Standard sperm candle (English candle) . . .	German Measurem'ts	1·14 (*b*)	*0·95*	..		0·974 (*c*)	..	..	..	*0·105* (*n*)	*0·051*	*1·01*
	Schilling	..	1·023 (*l*)	0·907 (*l*)		..	..	..	..	0·104 (*l*)	..	..
	Dibdin	..	..	..		..	..	..	..	0·105 (*d*)	..	..
	Kirkham and Sugg .	..	..	..		..	..	..	..	0·105 (*e*)	..	..
	Sugg	..	..	..	1	..	..	..	..	0·106 (*f*)	..	..
	Webber and Rowden	..	..	..		..	..	..	..	0·104 (*m*)	..	..
	Le Blanc	..	..	..		..	..	..	..	0·108 (*g*)	..	..
	Monnier	..	..	..		..	..	..	..	0·120 (*h*)	..	..
	Dutch Measurements	1·0854 (*k*)	*0·90*	..		..	..	..	0·68 (*k*)	0·104 (*k*)	..	..
1-candle pentane wick lamp (Vernon Harcourt) .	Liebenthal . . .	1·17 (*c*)	*0·975*	..	1·026 (*c*)	1	..	..	*0·70*	*0·108*	*0·052*	*1·04*
1-candle pentane air-gas lamp (Vernon Harcourt). . . .	Monnier	..	..	..	..	..	1	..	..	0·125 (*j*)	..	..
10-candle pentane air-gas lamp (Vernon Harcourt). . . .	..	..	..	..	..	..	..	1	..	..	..	..
Ether-benzol lamp	Dutch Measurement.	*1·69*	*1·41*	..	1·48 (*k*)	*1·44*	..	..	1	*0·155*	*0·075*	*1·5*
Carcel	German Measurem'ts	..	..	..	..	..	..	..	..		..	..
	Schilling	..	9·826 (*l*)	8·715 (*l*)	9·6 (*l*)	..	..	..	..		..	..
	Dibdin	*10·8*	*9·0*	..	9·5 (*d*)	*9·3*	..	..	*6·5*		..	..
	Kirkham and Sugg .	..	..	..	9·6 (*e*)	..	..	..	..		..	..
	Sugg	..	..	..	9·4 (*f*)	..	..	..	..		..	..
	Webber and Rowden	..	..	..	9·66 (*m*)	..	..	..	..	1	..	..
	Le Blanc	..	..	..	9·3 (*g*)	..	..	..	..		..	..
	Monnier	..	7·5 (*h*)	6·5 (*h*)	8·3 (*h*)	..	8·0 (*j*)	..	..		..	..
	Dutch Measurements	*10·45*	..	..	9·631 (*k*)	..	..	..	..		..	..
	Violle	..	..	..	..	..	..	..	..		0·481 (*i*)	*9·62*
	Laporte	10·91 (*o*)	..	..	..	..	..	..	..		..	..
Violle (Platinum unit)	Violle	*22·6*	*18·8*	..	*19·8*	*19·3*	..	..	*13·5*	2·08 (*i*)	1	*20*
Bougie décimale (Pyr)	1 *B.d.* = $\frac{1}{20}$ Violle .	*1·13*	*0·94*	..	*0·99*	*0·96*	..	..	*0 67*	*0·104*	*0·05*	1

* The author is much indebted to his colleague, Dr. Steude, for collaboration in the preparation of this table.

NOTES.

(*a*) German Committee on Photometry and Imperial Physical Technical Institute, "Journ. f. Gasbel." 1890, p. 597; 1893, p. 342; Krüss, "Bericht der Lichtmesskommission" (Munich, 1897), pp. 73-75.

(*b*) German Committee on Photometry, "Journ. f. Gasbel." 1890, p. 573; 1893, p. 342; Imperial Physical Technical Institute, "Journ. f. Gasbel." 1895, p. 511; Krüss, *loc. cit.*, p. 73.

(*c*) Liebenthal (Imp. Phys. Techn. Inst.), "Journ. f. Gasbel.," 1895, p. 511.

(*d*) Dibdin, "Public Lighting by Gas and Electricity," London, 1902, p. 33.

(*e*) Kirkham and Sugg; Schilling, "Handbuch d. Gasbeleuchtung," Munich, 1879, p. 214; W. Sugg and Co., "Gas Engineer's Pocket Almanack," 1902, p. 119.

(*f*) Sugg; W. Sugg and Co., "Gas Engineer's Pocket Almanack," 1902, p. 119.

(*g*) According to Le Blanc, Inspector of Lighting in Paris; Schilling's "Handbuch," 1879, p. 214.

(*h*) Monnier, Lecture to the French Society of Gas Engineers, 1883; "Journ. f. Gasbel." 1882, p. 758.

(*i*) Violle, "Des Etalons photométriques." Proceedings of the French Society of Gas Engineers, 1884, p. 366. "Journ. f. Gasbel." 1884, p. 764.

(*j*) According to Monnier; *cf.* Violle, *loc. cit.* p. 353, foot-note.

(*k*) Report of the Dutch Committee on Photometry, 1893, pp. 62, 72, 73; "Journ. f. Gasbel." 1894, p. 617.

(*l*) Measurements by N. H. Schilling; *cf.* "Handbuch d. Gasbeleuchtung," 1879, p. 214.

(*m*) Webber and Rowden. "Journal of Gas Lighting," 1869, p. 85.

(*n*) Mean value, omitting (*k*).

(*o*) Laporte. "Journal des Usines à Gaz," 1898, p. 204. "Journ. f. Gasbel." 1898, p. 624.

stearine candle, the one-candle pentane air-gas lamp of Vernon Harcourt, the Dutch ether-benzene lamp, the platinum unit, and the "*bougie décimale*," or "Pyr," based thereon, of Violle. The two latter have, however, only historical interest, and have never been applied in practical photometry. Consequently, they may virtually be left out of consideration. The remaining three standards just named have, like the six mentioned at the outset, been employed in comparative investigations for establishing the illuminating value of the standards in use, and they have therefore been included in the table. It would take too long to describe fully the methods by which the comparative measurements have been carried out; but they can be ascertained from the original sources to which references are given in the notes at the foot of the table.

The figures printed in roman type in the table refer to values which are the results of direct measurements, or the reciprocals of such values; while the other figures are values obtained by calculation from different series of observations. On collecting the values which show a tolerable degree of concordance, the relations between the standards of light which are in common use in photometry may be assumed with great probability to be as shown in Table II.

TABLE II.

	Hefner Unit.	German Candle.	English Candle.	Harcourt Wick Lamp.	Harcourt 10-Candle Lamp.	Carcel.
Hefner unit	**1**	0·833	0·877	0·855	*0·088*	*0·092*
German candle	1·20	**1**	*1·05*	*1·03*	*0·105*	*0·110*
English ,,	1·14	*0·950*	**1**	*0·97*	*0·100*	0·105
Harcourt's pentane wick lamp	1·17	*0·970*	*1·03*	**1**	*0·103*	*0·107*
Harcourt's 10-candle pentane lamp	*11·40*	*9·500*	*10·0*	*9·70*	**1**	*1·050*
Carcel lamp	*10·87*	*9 050*	9·53	*9·29*	*0·950*	**1**

The author proposes that Table II. shall be taken as the basis for deliberations on the second item of the scheme of work of the International Committee on Photometry. The ten-candle pentane lamp and the Carcel lamp have still to be compared, by collaboration with the Imperial Physical Technical Institute, with the Hefner lamp; consequently the values given for them must only be regarded as provisional.

After Dr. Bunte had given a *résumé* of his paper, as translated above, he proposed that the Committee should agree to accept the ratios given in Table II., pending further investigation, which would be undertaken by him and the authorities of the Imperial Physical Technical Institute at Charlottenburg, and probably by other members in other countries. Professor Vivian B. Lewes suggested that the Committee should agree to leave the investigations wholly in the hands of the Charlottenburg Institute. But Herr Brodhun and M. Vautier (the President) thought all the countries concerned should take part in the work. The President mentioned that in Paris the Conservatoire des Arts et Métiers would shortly be in a position to make comparisons, under the most favourable conditions, of the French, German, and English standards of light. In his opinion, this Institution should carry on tests simultaneously with that at Charlottenburg. Dr. Bunte thought it important that a ratio should be established which would be unhesitatingly accepted as a basis in interpreting the legal obligations entailed in contracts as to gas supply in which the illuminating power of the gas was fixed in terms of other units than those in vogue in the country. With regard to England, it was believed that the Metropolitan Gas Referees would be prepared to assist the Committee; but their resources for carrying out investigations were very limited. After some discussion, Professor Lewes said that, so far as England was concerned, the Gas Referees should first be asked to undertake the comparisons proposed by the Committee; but if they were unable to do so, he and Mr. Helps would do all that was possible, and would endeavour to interest the Institution of Gas Engineers in the matter.

At the request of the President, Dr. Bunte explained that Table I. in his paper was as complete a compilation as possible of all testings by whomsoever made. The results were not therefore all equally trustworthy, and it was necessary to make a selection, excluding those which, by reason of lapse of time, lack of proper appliances, &c., were open to question. Discarding in this way extreme or dubious results, he had arrived at the mean values shown in Table II.

M. Sainte-Claire Deville drew attention to the fact that all the standards at present in use afforded a yellow light, which was similar in colour to the light of the old self-luminous gas-flames, but was not well suited for comparison with the incandescent gas-light, for which a standard affording a white light ought to be found. As, however, two forms of photometer—viz., that devised by Messrs. Carpenter and Helps, and the Simmance-Abady apparatus—both of which aimed at overcoming the difficulty of comparison referred to, were to be brought before the Committee later, it was decided not to pursue the discussion of the point raised by M. Sainte-Claire Deville until these photometers were being considered.

The Committee then passed unanimously a resolution proposed by Professor Bunte to the effect that "comparative photometric testings should be made independently in Germany, England, and France, for the purpose of establishing the ratios subsisting between the standards of light enumerated in Dr. Bunte's Table II., with the exception of the one-candle pentane wick lamp of Vernon Harcourt; and that provisionally the values given in that table should be accepted for the comparison of the photometric results."

Herr Brodhun expressed the opinion that the work projected could be simplified if it were decided to carry out the testings in a particular order. He thought the ratio between the carcel lamp and the Harcourt 10-candle lamp should be ascertained by comparing each in turn with the Hefner lamp as a standard. M. Sainte-Claire Deville, however, wished to have the carcel and the Harcourt lamps compared directly with each other, as a comparison could be carried out in a more trustworthy manner when, as in this case, the two lights were of similar colour and form, and had approximately the same intensity. Herr Brodhun remarked that it might be difficult to arrive at a definite agreement if the triple set of comparisons were made, and that the Hefner lamp had a claim to be preferred as the ultimate standard of reference because it had been investigated with extreme exactitude, and the possible error with it was known not to exceed 1 per cent. He, however, agreed to propose, in conjunction with Dr. Krüss, the following resolution, which was unanimously passed by the Committee: "The comparative photometric testings are to be carried out in the following order: Hefner lamp with Carcel lamp, Hefner lamp with Harcourt lamp, and Carcel lamp with Harcourt lamp."

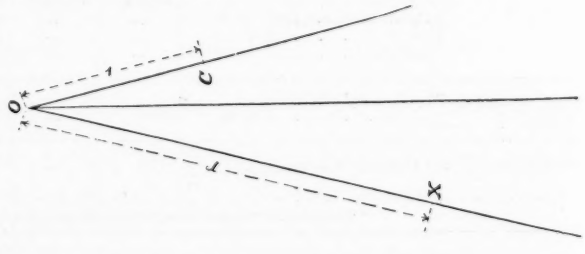
Professor Lewes desired it to be put on record that the investigations ought ultimately to be extended to the English standard sperm candle itself, as it was of great historical interest, and was the most usual standard in England at the present time. He remarked that some authorities in this country believed that the 10-candle Harcourt pentane lamp represented only about 9·8 instead of 10 standard sperm candles. The Harcourt lamp rested solely on the authority of the Gas Referees, who had jurisdiction only in the Metropolis. Professor Bunte pointed out in this connection, however, that the ratio between the English candle and the Hefner light had been satisfactorily established some time ago in Germany, and that the only missing comparison to complete the chain was that between the Harcourt and Hefner lamps.

The President then called upon Signor Böhm, of Turin, to give an account of a method which he had elaborated for the comparison of incandescent gas-lights. This method is described in the paper by Signor U. Della Casa and Signor M. Böhm, both Engineers, of Turin, of which the following is a translation.

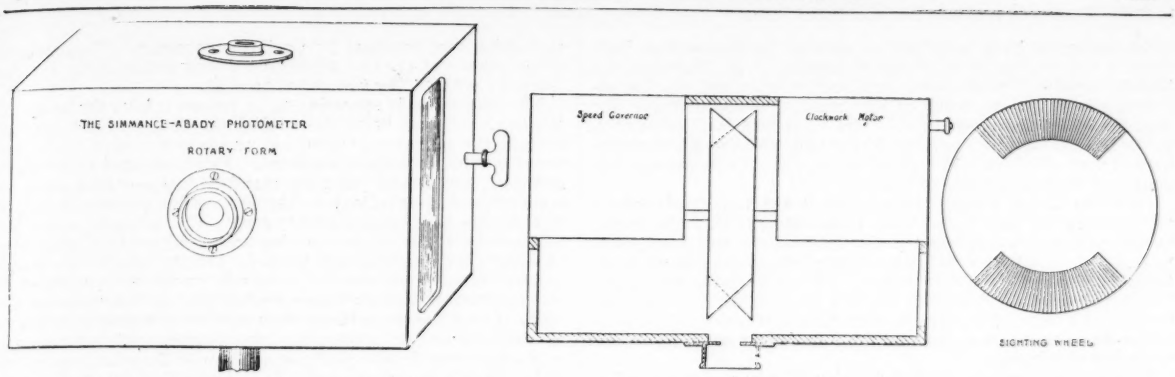
A METHOD OF DETERMINING THE LUMINOUS INTENSITY OF INCANDESCENT BURNERS.

The difficulty of comparing an incandescent burner with a standard of light such as the carcel lamp is generally admitted by all who have had to do with photometry. The difference of colour between the two light sources does not allow the eye of even the most practised observer to make a proper valuation of the intensity. The system here described is therefore proposed. Even if it does not afford mathematically exact results, it will serve sufficiently well in practice, because it approximates thereto. Its application may perhaps follow because it is simple, and requires no new photometer. The ordinary apparatus found in almost every photometer-room can be employed.

It is difficult, on the one hand, to set up and reproduce in different places an identical standard based on the incandescent gas-flame, because the inherent properties of the gas vary according as it is made in different works, and even at different times in the same works. Thus it will readily be seen that it is much better to fall back upon a standard which is not dependent upon the quality of the gas. Consequently, the carcel standard, which being already much used is well known, and has given good results, can be reasonably employed in connection with the new method of utilizing gas.



The method which the authors have adopted for determining the luminous intensity of incandescent burners, and which forms the basis of the proposed system of testing, requires the use of Foucault's photometer, which is arranged as shown in the accompanying diagram, in which the point O represents the eye of the observer, C the carcel-lamp, X the incandescent burner, and r the distance between O and X. For comparing lights of different colours—for instance, the green incandescent gas-light and the yellowish-red carcel flame—two descriptions of glass are provided. These, in the case in question, are yellowish red applied



to the mantle, and green for application to the carcel, at the photoped of the photometer. Evidently it would be very difficult to find glasses which would render the colours of the two sources of light precisely equal; but it will be apparent from the sequel that it is not absolutely necessary to have such equality.

First of all, the green glass is placed between the carcel and the photoped, and the incandescent burner is moved until equality of impressions to the eye is obtained. If the value of the intensity of the mantle, using the green glass in this manner, is represented by Xv, and the distance read on the scale of the photometer by r', the law of the squares of the distances will give—

$$(1) \qquad X = r'^2\, Cv$$

On taking away the green glass, and putting between the incandescent light and the photoped the yellowish-red glass, and again sliding the incandescent burner until equality is attained, the equation will be—

$$(2) \qquad Xv = r''^2\, C$$

Finally, using the two coloured glasses simultaneously—the yellowish-red glass on the mantle and the green one on the carcel—and making comparative readings, it will be found that—

$$(3) \qquad Xv = r^2\, Cv$$

There are thus obtained three equations, with the three unknown quantities X, Xv, Cv; and by elimination it follows that—

$$X = \frac{r'^2 \times r''^2}{r^2}\, C$$

If equality has been arrived at in the first two testings, it may be found at the third testing, when both glasses are used, that equality can no longer be established. But this has not the importance it might seem to have at first sight, because of the impossibility of actually obtaining precise equality in the first two testings. The slight differences which occur, and have no influence on the settings, are neutralized in the third testing.

Tests made by this system have given good practical results, and have been checked by comparing two incandescent burners of which the illuminating power had been first of all tested according to this system. Some results of the use of this method may be referred to.

Before making observations, the consumption of colza oil in the carcel lamp was first of all checked, and found to be 10 grammes in 14 min. 12 sec. This indicated proper behaviour. Then with a pressure at the burner standard of 12-10ths, and using an ordinary mantle, the following results were obtained:—

$$Xv = 1{\cdot}89^2\, C\ ;\ X = 4{\cdot}70^2\, Cv\ ;\ Xv = 3{\cdot}38^2\, Cv$$

From these, it followed that—

$$X = \frac{(4{\cdot}70 \times 1{\cdot}89)^2}{3{\cdot}38}\, C = 6{\cdot}76\, C$$

Giving the carcel the value of 9·6 candles, the result became X = about 66 candles.

In order to test these figures, another test was made on a very much smaller mantle than the last one, and the following results were obtained:—

$$X^1v = 1{\cdot}38^2 C\ ;\ X^1v = 2{\cdot}62^2 Cv\ ;\ X^1 = 2{\cdot}40\, Cv$$

From these it followed that—

$$X^1 = \frac{(2{\cdot}62 \times 1{\cdot}38)^2}{2{\cdot}40}\, C = 2{\cdot}25\ C = \text{about } 22$$

The two mantles were then set up on a bunsen photometer, and tested at the same pressures as before, and the result obtained was $X = 3\ X^1$. On referring to the figures obtained by the direct application of the authors' system, it will be found that $X = 3 \times 2{\cdot}25\ C = 6{\cdot}75\ C$; and directly $X = 6{\cdot}76\ C$.

Such results enable the authors to assert that the method described is applicable in practise, because the discrepancies which it shows come within the ordinary experimental range of error.

In the discussion which followed Signor Böhm's account of the method described in the foregoing paper, Herr Brodhun pointed out that the principle employed had already been adopted by Weber in constructing a photometer, while Crova also had worked on similar lines. Herr Brodhun, Dr. Bunte, and M. Sainte-Claire Deville were all of opinion that the method did not afford a sufficient guarantee of being exact.

The proceedings of the Committee were then adjourned till the afternoon.

Before the resumption of proceedings on Saturday afternoon, the members of the Committee were entertained at lunch, at the Hotel Bellevue, by the Corporation of Zurich; and the President of the Town Council, Herr Pestalozzi, in a few well-chosen words, enlarged on the importance of the work which was occupying attention. The President of the Committee, M. Vautier, in reply, expressed the appreciation of that body of the interest and assistance which the town had extended to them.

Proceedings were resumed in the afternoon at the Chemical Department of the Zurich Polytechnic. The members first of all inspected the photometer devised by Messrs. Carpenter and Helps for determining the illuminating power of incandescent gas-lights. It was shown in operation, and explained by Mr. Helps, while a paper describing it was read on Monday morning by Mr. Carpenter. This paper is reproduced p. 960. At the close of the demonstration, Professor Lewes, at the request of the President, gave a short address on the different methods available for testing the intensity of incandescent gas-lights.

Professor Lewes said that the much-discussed difficulty of deciding upon the equality of two lights of different colours was in reality overcome by practice; so that the expert photometrist was able to make perfectly concordant and trustworthy measurements of the intensity of incandescent gas-lights on an ordinary photometer. A practised hand regarded the amount of illumination of the edge of the circle or illuminated surface, instead of the general illumination of a disc. Consequently, it facilitated photometric observations of incandescent gas-lights if the disc were a quite small one, on which the eyes could concentrate their attention, and be restrained from travelling over a large surface. This reduction of the space over which the eye travels, was of great advantage in testing incandescent gas-lights. But in any case where the observer had not had much experience at this class of photometrical work, it was best for him to use one or other of the special methods, which brought his work up to that of the expert observer in respect of accuracy. One of these methods had already been described by Signor Blöm (*vide supra*). Another method, which would be described in the paper by Messrs. Carpenter and Helps (*vide infra*), utilized what might be described as a secondary Methvenized mantle standard. By this method, the colour difficulty was transferred to a second bar, and was confined to a small portion of the total light of the incandescent light to be measured. The last method was that of the "Flicker" photometer, as adapted by Messrs. Simmance and Abady (see "JOURNAL" for the 9th inst., p. 664). This would be described more fully by Dr. Bunte, who would show it to the Committee at the next sitting. A slide was driven to and fro between the lights and the photoped of a table photometer by means of a small electro-motor. When a speed which gave sixteen cuts-off per second was attained, the eye lost the impression of colour, and readings could be made with extraordinary sharpness. On first using this form of photometer, he had noticed that the observations made with it of the illuminating power of mantles gave lower results than those made by practised observers on an ordinary photometer. The variations appeared in a large measure to be due to the one-candle standard used on the Simmance-Abady photometer; and he had come to the conclusion that the principle employed in that photometer should be applied to a bar photometer, as it ought then to answer quite well. Such an arrangement had now been carried out by Messrs. Simmance and Abady. It is shown in the above illustration, which represents a form of their photometer only differing from the table form in that it may be used on a bar with lights at right angles to the line of sight. It can thus take the place of the Bunsen disc and box, the Lummer-Brodhun, and other similar apparatus. Its principle is the same as that of the table-form of the Simmance-Abady "Flicker" photometer. The eye sees, alternately, the rays from the two lights; but in this case the rays are reflected instead of direct. A wheel having its periphery cut into teeth, bevelled to right and left alternately, is rotated with its axis at right angles to the line of vision. In this manner, a white surface illuminated by the light from one source is presented to the eye; and as the wheel rotates, this surface is constantly being alternated with the one which faces it obliquely. Thus there is no perceptible interruption in the reflected light. In this way, with the rotation of the wheel, reflected light from each source of light alternately strikes the eye; but the change from one to the

other ceases to be perceptible as soon as the illumination from the two sources becomes of equal intensity. In this form the Simmance-Abady photometer may be reversed; and may be adjusted for comparing lights at any angle. It is available for use on any bar photometer. The sight-hole is fitted with a piece of translucent paper—as in the Gas Referees table photometer; and the wheel is rotated so that it affords sixteen impacts per second on the photoped.

Professor Lewes went on to say that it was a great advantage of this form of photometer that it admitted of the light being measured at any angle, because the light which was most generally useful was that which was emitted from the source at an angle of about 45° to the horizontal. When tested at this angle, the much maligned flat-flame burners gave relatively very good results. In conclusion, he asked the Committee not to tie themselves down to adopt any particular form of photometer, to the exclusion of others.

Professor Lewes was thanked for his address; and the meeting then passed on to the consideration of a method of testing the strength of mantles. It will be convenient, however, at this stage to give the paper by Messrs. Carpenter and Helps on their new form of photometer, which was read on the Monday morning by Mr. Carpenter. The discussion on this and the other forms of photometer referred to by Professor Lewes was taken at the same time, and will be reported (together with the concluding proceedings of the meeting) in next week's "JOURNAL."

AN IMPROVED PHOTOMETER FOR TESTING THE ILLUMINATING VALUES OF ORDINARY AND HIGH-POWER AUER BURNERS.

By CHARLES CARPENTER and JAMES W. HELPS.

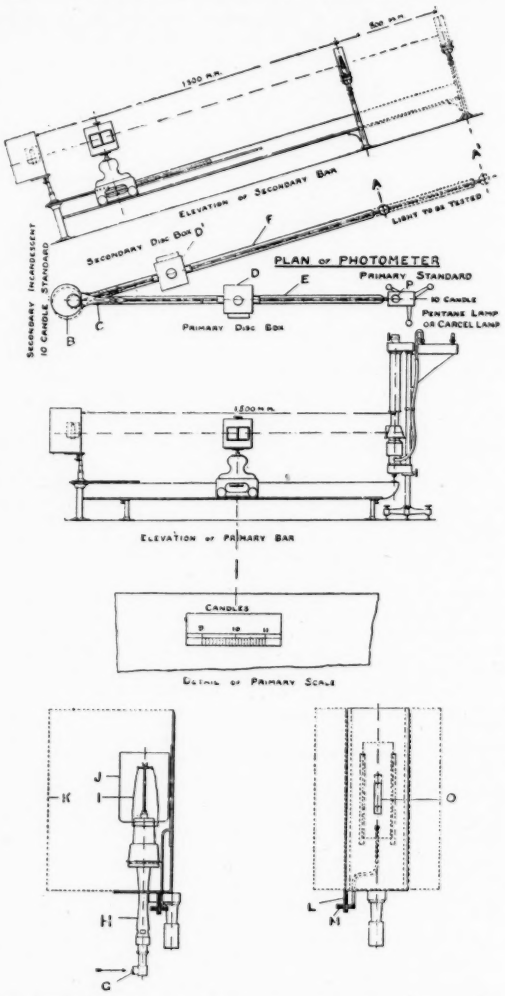
The rapidly extending use of the Auer burner, both for public and private lighting, and the great improvements in its construction and in the manufacture of mantles that have been made during the last two or three years, by which illuminating effects have been obtained comparable with those produced by the electric arc, have quite changed the photometrical necessities of the gas engineer. For testing the light-giving values of ordinary burners, whether flat-flame or argand, or of those higher power ones based upon the regenerative system, the Carcel lamp used with the Faucault photometer formed an admirable standard of comparison, since the light emitted therefrom scarcely differed in quality, and but little in intensity, from that given by the burner under test. It is satisfactory to be able to state that the Gas Referees, who are the authority for prescribing the photometrical methods used in London, have at last realized the advantages of the system so long in vogue in Paris, and have based thereon their official photometer. The standard light, however, is not the Carcel lamp (the value of which is about 9·6 English sperm candles), but a lamp burning pentane; the flame being screened so as to emit a light exactly equal to 10 standard English candles. When, however, it is attempted to use either the Carcel or the pentane lamp for the direct comparison of light emitted by an Auer burner, great difficulty arises, owing to the difference in quality of the two sources of illumination.

The object of this paper is to bring under the notice of the members of the Commission Internationale de Photométrie a simple form of apparatus, which has been for some time in use by the South Metropolitan Gas Company, of London, for ascertaining the illuminating power developed by various forms of incandescent burners and mantles in terms of the standard referred to above.

The method followed will now be described. The standard lamp is not compared directly with the light to be tested, but serves to fix a predetermined value to a secondary standard of the same quality and colour as the light under examination, and with which therefore it can in turn be readily compared. The secondary standard is produced by surrounding a suitable incandescent burner with an opaque screen in which is cut a vertical narrow slot. The slot is provided with a sliding shutter actuated by a fine screw, by means of which its length, and therefore the amount of light emitted, can be varied at will. Two divided scale bars are used, having a terminal common to both at the secondary standard. They may be arranged in the same straight line with, or their opposite terminals may approach towards, each other so as to make any convenient angle, which in the photometer illustrated is an acute one. The primary scale is provided with a moveable screen box containing a reversible Leeson star disc or other suitable device; the scale being divided equally from the centre towards the primary and secondary standards. The secondary standard rotates about the junction of the two scale bars, and is provided with an index pointer, by means of which it can be set to occupy the same relative position to either. On the secondary bar is mounted a reversible Bunsen disc box, and at the other terminal the light to be tested.

In the diagram, E is the primary scale, and F the secondary. The standard lamp is fixed at P, and the light to be tested at A or A^1, according to its intensity. The primary screen box is shown at D, and the secondary at D^1. The secondary standard B is fixed in relation to either scale bar by means of the index point C. The secondary standard is shown in greater detail by the enlarged drawing. The incandescent burner H used is of the well-known "Kern" pattern, consuming about 3¼ cubic feet of gas per hour, and is supplied through the flexible connection G; the gas pressure being kept constant by a suitable governor. The moveable slot is shown at O; the adjustment being obtained by the fine screw L, actuated by the milled head M.

The procedure of operating is as follows: After the lamp and burners have been alight for a sufficiently long period to become normal, the operator proceeds to regulate the light emitted by the slot of the secondary standard. This is effected by making a series of comparisons with the standard lamp—varying the slot opening until the readings on the scale of the pointer of the disc box do not vary sensibly from zero. The secondary standard will thus be giving an illuminating power either of a Carcel or 10 candles, whichever lamp may be used. It is then rotated so that the pointer index coincides with the secondary scale bar, and direct observations of the burner under observation may then be proceeded with. It has been found that, when once set, the standard remains constant for several hours; but it is, of course, extremely easy to continue its verification by comparison with the primary standard right through the experiment. It is found that this can be done with great accuracy, owing to the lights being of equal intensity



though differing in colour. The authors have tested incandescent burners varying from 50 candles to nearly 1200 candles, and with satisfactory and concordant results.

The details of the photometer can, of course, be varied to suit different conditions. For instance, the secondary disc box may be fixed on the bar at the same distance from the incandescent standard as the primary disc box. In such case the light to be tested must, of course, be moved in making the observations.

In conclusion, the authors expressed the hope that the method they described for comparing the illuminating power of incandescent burners by reference to a secondary standard of exactly similar quality, rated in turn by a Carcel or pentane lamp, would be worthy of discussion by the members of this Commission.

Investigations into the nature of underground waters in Connecticut and Michigan have been undertaken by the United States Geological Survey. The work in the former State will be in charge of Dr. Herbert E. Gregory, of Yale University; and that in the latter will be done by Mr. W. F. Cooper, under the supervision of Dr. A. C. Lane, the State Geologist. All the available data relating to springs, wells, and the geological conditions affecting sub-surface supplies are to be collected and studied with the idea of securing results of practical value to present or prospective well-owners.

OBITUARY.

The recent death is announced of Mr. W. P. Hotchkin, the Manager of the Coggeshall Gas-Works.

We regret to record the death of Mr. George H. Cross, Assistant to his father, Mr. Samuel Cross, of Abergavenny, and brother of Mr. F. W. Cross, of Lea Bridge. He had suffered more or less from ill-health tor two years, and in the hope of effecting some improvement, he went over to America. This trip appeared to have benefited him greatly; and he started for England. When coming up the Channel, on Monday last week, he suffered from the prevailing fog getting upon his chest. On landing at Plymouth, it was too late to proceed to Abergavenny, so he stayed with friends at Bristol. After retiring at midnight, an attack of asthma set in; and, notwithstanding the greatest medical and other care, he succumbed to heart failure before three o'clock the next morning. The news of his sudden death was received with keen regret at Abergavenny, where he was much respected; and his remains were followed to their last resting-place by the Mayor and members of the Corporation, as well as by a number of the local Freemasons.

PERSONAL.

Mr. F. E. Stimson, of Croydon, has been appointed Manager of the Spalding Water-Works, in succession to his father.

Mr. C. J. P. Wadham-Smith has resigned the position of Manager of the Brigg Gas-Works in order to take a similar position at Skegness.

We are sorry to learn that Mr. Charles Taylor, who for many years was Engineer of the Derby Gas Company, is very seriously ill. He has for some time been in failing health, and for the last ten days confined to the house. We are sure his many friends will join with us in sincere sympathy with him, and in expressing the hope that he may be restored to health again. It is only three years since he resigned his position, and we trust he may be spared to longer enjoy his well-earned retirement.

Alderman J. T. Bond, who has been Chairman of the Water Committee of the Plymouth Corporation since 1891, has decided to retire from that position, in consequence of the demands made upon his time in connection with the Education Committee, of which he is also Chairman. During the twelve years for which he has presided over the Committee, the water undertaking has greatly developed. The revenue, which in 1891 was £13,839, is estimated this year to produce £28,260. Of course, the expenditure has grown in proportion, and considerable works of extension and improvement have been carried out. The most important of these has been the construction of the Burrator storage reservoir and the substitution of a main for the open leat in which the water formerly flowed from Dartmoor to the town.

Mr. John Lang, Assistant-Manager of the Dumbarton Corporation Gas-Works, has been appointed, out of 71 candidates, Manager and Secretary of the Fraserburgh Gas Company. Mr. Lang was trained by Mr. J. M'Gilchrist in the works at Dumbarton. Last year he gained a first-class certificate in the Honours Grade in the examinations in "Gas Manufacture." He also holds a Queen's Prize in advanced chemistry, and certificates in electricity and other science subjects. While at Dumbarton, he has had considerable experience in preparing plans for new gas-works as well as for extensions of others in Scotland. The works at Dumbarton have furnished many successful gas undertakings in the United Kingdom and Ireland with managers, all of whom have given a good account of themselves as well as of their instructor.

Consequent upon the resignation by Mr. R. J. Sharman of the managership of the Wisbech Gas-Works, as announced in the "Journal" for the 2nd inst., the appointment of Mr. J. G. Hawkins, of Spalding, as his successor, has just been made. We congratulate the Company on their selection. Mr. Hawkins has been at Spalding nearly twelve years, in the first three of which the price of gas was reduced from 3s. 9d. to 2s. 6d. per 1000 cubic feet, notwithstanding the coal famine and other troubles. In addition to this, the public lighting has been done practically free, and the works have been rebuilt at a cost of £20,000, entirely out of profits. These facts bear testimony to the possession of good managerial qualities, for the exercise of which Mr. Hawkins will find scope in his new sphere of labour. His appointment includes the management of the water-works.

In the report on the work of the Society of Arts last session presented at the recent annual meeting, appreciative reference is made to the course of Cantor Lectures on "The Future of Coal Gas and Allied Illuminants" delivered by Professor Vivian B. Lewes. The indebtedness of the Society to Professor Lewes is expressed "for many brilliant courses of lectures and papers on this subject, the value of which has always been attested by the large attendance of those connected with the industry which these lectures have always attracted."

COMMUNICATED ARTICLES.

NEW MACHINES FOR OLD.

By C. E. Brackenbury.

Quite recently it has been my privilege to see, in actual operation, one of the largest and most complete installations of inclined retorts in the world, and also both the new systems of machinery for horizontal retorts, which have been so fully and interestingly described lately in the columns of the "Journal." The articles referred to have, I know, met with wide appreciation; and when at the Paris Gas Company's offices, great satisfaction was expressed by the Engineers at the eulogies that have been passed upon them and their work. I should like to be allowed to add my meed of praise, and at the same time to express my thanks to MM. Bertrand, Euchène, Gigot, Aubrun (the Superintendent of La Villette Gas-Works), and others for their many acts of courtesy, and for the information they so willingly gave. On the date of my visit, there was quite a little international gathering of engineers, as Mr. Edward Drory, of Berlin, and other gentlemen were also inspecting the turbine machines at the same time. It would be of great interest to have all their different views on what was shown them.

"Well, what do you think of the machines?" is a question that has been put to me several times since my return; and it is in the hope of conveying some impression of those thoughts that I write these lines. The opinions that I have seen thus far expressed vary from the wisely cautious to the wildly enthusiastic. "Inclines are dead; Long live machines" seems to be the cry of some. It would appear to be difficult in the face of any novelty, or the introduction of any new process, or the formulating of any new proposal, to avoid being unduly optimistic and claiming too much on the one side, or unnecessarily pessimistic and denying too much on the other. I am desirous of erring in neither direction. My faith in inclined retorts, in suitable cases, is not so feebly founded as to be lightly shaken by the first breath of a centrifugal charger. My high opinion of West's compressed-air stoking machinery and Arrol-Foulis hydraulic machines, in suitable cases, is not shattered by the introduction of an electric turbine or projector.

On the other hand, I fully recognize the labour-saving possibilities and cost-reducing probabilities of the Paris machines; and I thoroughly appreciate the beautiful simplicity and lessened expenses of the Bruges belt. But I am afraid that I have not been gifted with the happy mutability (say) of Mr. F. D. Marshall, who, in 1898, "comparing the inclined system with power stoking, argued that everything, including common sense, pointed in favour of the former plan," yet, in 1903, "metes out conscientious and unqualified praise on a machine stoker." He who, in 1898, described power stoking as "turning an otherwise decent-looking retort-house into something between a pit-head and a machine shop," might add, in 1903, were he the same Mr. Marshall, "electric tram and ship's turret." In 1898, "he had had a mechanical stoker; but after some time he determined it should be the last." In 1903, Mr. Marshall "is so convinced of their (machines') superiority, that he has secured from the Paris Gas Company the British and Colonial rights in the invention." No! the metamorphosis of Mr. Marshall in five short years certainly does "seem a trifle odd." *Tempora mutantur* is all very well, but this is *Tempora mutantur* with a vengeance!

For my own part, I gladly see in the introduction of these new machines indications of progress—but not of revolution. The margin of advantage hitherto held by the inclined system of carbonization over the horizontal, may very possibly be reduced; but it is certainly not wiped out. The gulf between the two may have been lessened; but it has not been bridged. Some considerations that have led to the forming of this opinion, and a few other notes, may perhaps be given.

It must not be overlooked that the machines and their accessory plant in the present stage are more or less experimental. The second turbine charger is a very different machine from the first—with modified coal-hopper and feed, and with the turbine motor rising and falling according to the tier of retorts to be charged, instead of being stationary as before. At the time of my visit, the first type of charging machine at La Villette was being thoroughly overhauled and modified after twelve months' continuous work. The De Brouwer charger is likewise, I understand, subject to modified arrangements of pulleys, having either two or three; and also the material of them, and of the fly-wheel, may be changed, wood having been suggested. I mention these points merely to show the somewhat embryonic state of the machines, and to bring home the fact that we are not discussing any definite, hard-and-fast apparatus, but something liable to distinct alteration—and, I trust, improvement. These new machines will vary according to the conditions of their installation just as the old ones have done. Also, it must be borne in mind, as wisely pointed out in the "Journal" articles, that the accessory plant up to the present has been of a very tentative character. The cost and difficulty of getting coal to the charging machine, and coke away from the drawing or pushing machine, are often

far greater and more expensive problems than the mere charging and discharging operations themselves.

I do not quite see where any economy is likely to be effected by the new arrangements in this particular. The same amount of coal (or even greater) has to be broken, elevated, conveyed, and stored, either in continuous or central hoppers, just as was formerly the case; but now it has all to be concentrated on one side only of the retort-bench. The same applies to the coke, which has to be got away in equal (or larger) quantities as before, with the only difference that it will be in one stream instead of two. The accessory apparatus for these new machines may therefore be expected to approach in character that required for inclined-retort installations. Particularly is this the case with the De Brouwer projector. The same breaker, elevator, conveyor, continuous hopper in all probability, certainly the same measuring chambers and the very levers, absolutely the same as for inclined retorts, but *plus* a machine—or is it going to be two machines? For a charging machine alone can hardly be considered as enough in itself, however simple and excellent it may be; it is but a part, and a small part, of the whole. It is like offering a man who wants both horse and cart, the cart alone.

We now come to the question of first costs. At this early period, I consider it somewhat premature to enlarge on what must of necessity partake more or less of the nature of vague estimates. I only mention them to call attention to a curious coincidence. The issue of the "JOURNAL" which contained Mr. Marshall's comparative statement on the subject also recorded figures of a similar comparison made by M. Frère at the recent Société Technique Congress. The translated results are interesting, if nothing more—

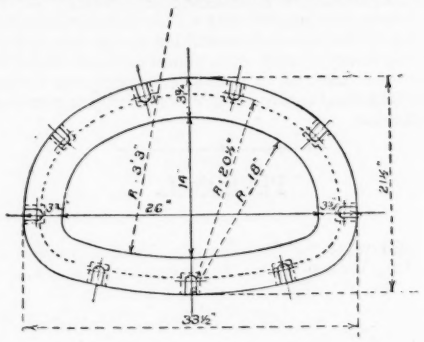
Mr. Marshall's cost for installing the inclined system, per 1000 cubic feet of gas made per 24 hours . . .	£21	13	0
M. Frère's cost for installing the inclined system, per 1000 cubic feet of gas made per 24 hours	10	15	0
Mr. Marshall's cost for the turbine system, per 1000 cubic feet of gas made per 24 hours.	17	8	8
M. Frère's cost for the De Brouwer system, per 1000 cubic feet of gas made per 24 hours.	11	7	0

The power for driving both the new types of machines is electrical; and this is a feature I welcome very cordially, as I have advocated it, and the more general use of electricity for light and power in gas-works, more than once in the past three or four years, on account of its adaptability, speed, and cleanliness, &c. It has met with opposition. I seem to remember a recognized head of the gas industry once saying something to the effect that gas, and gas alone, had been good enough for him, as it had also been for his father before him. Mr. Charles Hunt also recently advised the Midland Gas Managers Association to "let electricity alone." But I gather that he referred to it more particularly as an illuminant; and perhaps he would not have the same objection to using it for motive purposes, even within the precincts of a gas-works itself. To Mr. J. D. Ashworth, however, "the use of electricity in gas-works seemed like taking the bread out of their own mouths. He should never advocate that." I myself do not believe in this false protection policy; and if gas and gas-works' material can be better and more cheaply made and handled by the adoption of electricity in any form, it seems to me obviously advantageous to use it.

I hope to see, therefore, as one result of the introduction of these electrically-driven machines, the breaking-down of the narrow-minded, short-sighted prejudice, no doubt existing in some quarters, against the employment of electricity in gas-works. I look forward to the regular establishing of electrical equipment in gas-works; the power required varying, of course, greatly according to the arrangement adopted. The power needed for coal and coke apparatus for similar-sized plants on whatever system may be taken as identical. Inclined-retort charging requires the power of a man's hand. The Bruges belt takes about 3-horse power. The Parisian turbine wants, I believe, 24-horse power, if not more; and the pusher, 12-horse power. For machine charging, a combination of the De Brouwer projector with the Paris ram immediately suggests itself as feasible in practice and economical in power—provided always that the lightness and simplicity of the former be not compromised by adding this or that to it, such as a coal-hopper, and its framework and weight and rails and travelling and raising motors, &c. If all these additions to the machine ever be made, then "good-bye" to its attraction, simplicity, and cheapness; and I believe that, on comparing all the machines, both old and new, fashioned on the same plan, there will prove to be very little difference, weight for weight, work for work, men for men, and cost for cost, between water, air, belt, and turbine.

Something has been heard of the speed of charging realized by the new machines. One claimant quotes 240 retorts per hour—that is, 5760 retorts per twenty-four hours on continuous working, which is equivalent to a retort-house over three times the size of that (say) at Windsor Street, Birmingham, or East Greenwich. Are not such figures very futile? What purpose do they serve? The speed of charging is limited by the speed of drawing or pushing, which is, again, oftentimes limited by the speed of coke conveying. Then there is the time for coal receiving, and often for producer filling; so that to state barely that a retort can be charged in so many seconds answers no practical purpose whatsoever. Then, again, how many works are there large enough to find full employment for even the slowest of stoking machines? Besides all this, I myself have seen a West air-compressed machine, in ordinary work, charge and draw complete 42 retorts in one minute under the half-hour; while at East Greenwich the rope-driven machines, I believe, do 700 retorts in twelve hours, or 720 minutes. It is true that, with one pair of machines, instead of two, the duty per machine is increased, but the number of retorts served within a given time is not.

The form of the retort is of great importance. The most general Continental section (which I have often described and advocated) is a shallow Ω, either with flat or curved bottom, 65 cm. wide by 35 cm. deep, or about 25⅝ inches by 13¾ inches. Its carbonizing qualities are excellent. Whether the floor of the retort be curved or flat is, as M. Euchène remarked to me, "*une chose de sentiment.*" Even among the Paris Gas Company's Engineers, some prefer the one form, and some the other. The Paris



retorts, as is known, are corrugated; being between 50 and 60 mm. (2 inches and 2⅜ inches) thick, and considerable saving in fuel is reported from their use. But this is a digression. The shallow section of the retort renders all but compulsory the adoption of a ram for discharging the coke, if stoking machinery is to be installed. I have worked the ordinary drawing machine rake with such retorts; but the result was that the charges of coal had to be reduced from those formerly put in by hand, so as to allow more clearance for the passing of the rake-head between the top of the coke and the roof of the retort. Eventually, the retorts were slightly increased in depth, so as to reduce the difficulties encountered.

The second type of turbine machine and discharging ram at La Villette is now working only on an experimental bed of retorts, having the same dimensions as usual (65 cm. by 35 cm.), but made rectangular, with a view to putting in increased charges. M. Euchène, however, informed me that their experience was that it was not advisable to increase the weight of coal beyond a certain reasonable quantity, and that, therefore, they would retain the usual shape of retort, with the usual average charges of about 350 kilos. of coal (7 cwt.). Undoubtedly, as Mr. Charles Carpenter surmises, the shape of the Paris retorts tends to facilitate the discharging; and if the same weight of the same coal were to be put into an ordinary English section of retort, I should not anticipate the same good result. If the heats were identical in the two cases, the French charge would be the better burnt off, owing to the wider retort and thinner layer of coal. And as generally the heats abroad are much higher than at home, there will be these two points—temperature and shape of retorts—that will require to be carefully watched in any estimates, and allowed for in anticipating results.

Mr. Marshall, in his calculation of the cost of carbonizing with the turbine machine, quite light-heartedly takes as his unit the extraordinarily heavy charge of 1300 lbs., which is over 11½ cwt., or 590 kilos. Of what elastic material are his retorts to be made, and at what wonderful heats is he going to carbonize? The average charge per 20-feet retort in sixteen English gas-works, which I recently had the privilege of visiting, was only 743 lbs., or about 6⅔ cwt., or 337 kilos. In the splendid carbonizing, wide and shallow Continental retort, one can distil, under favourable conditions, 400 kilos. (8 cwt.) of Durham coal in six hours, and, very occasionally, even 450 kilos. (9 cwt.). But, as I have experienced, this latter amount is altogether out of the question in normal working with English-shaped retorts—say, 22 inches by 16 inches. What, then, is going to happen to Mr. Marshall's charge of 11½ cwt. or 590 kilos.—an increase of nearly 50 per cent. above the Continental average, and of 75 per cent. above the English one? It must certainly be confessed that his charge is an astonishingly high one, and, consequently, his cost result an "astonishingly low one!"

Engineers and contractors are generally too sanguine as to the first cost of any installation, and as to the working expenses, and as to the number of men to be employed. Estimates have an awkward way of being exceeded; and the anticipated saving in labour by the introduction of any mechanical appliances is often far from being realized. Of course, I am not now speaking of those engineers who do not want to reduce the number of men in their works, and who know of nothing "more delightful to witness than the smartness, the neatness, and the efficiency of a gang of men charging retorts in the old-fashioned way." To such, these improvements in mechanical stoking (and all progress in labour-saving machinery) must, I suppose, appear as evidences of modern

decadency, and as evils hardly to be tolerated. But I speak of those engineers who believe in "the general advancement of mechanical science," who wish to save their fellows brute-like labour, and who desire to adopt all possible means for the best and most economical manufacture of the commodity they deal in "for the use and convenience of Man."

Is it really true that the new type of machine will "wipe away at once one-half of the men required in charging a 20-feet retort in the ordinary way by machinery"? Obviously, with two machines as against four, there will only be half the previous number of machine men. But will there not generally be, in an average works, one man opening and one man shutting lids on each side of the bench as before? It seems so to me; and thus instead of eight men per shift, there would be only six—that is, you wipe away one-quarter. And in smaller works, and in making the comparison with a combined charging and drawing machine, would even this reduction in the retort-house staff hold good? These are questions which only practice can decide, and the answers to which will vary greatly even then, according to the size of the works, the local conditions of labour, special circumstances, and the hundred-and-one things that come in to vitiate any attempted comparison.

I can corroborate the statements of the "JOURNAL" second article. Both the De Brouwer and the Paris machine "can put a charge into a 20-feet retort quickly, well, and without any pause or movement during the charge;" and in both cases, "the level of the charge is all that can be desired." The discharging ram at La Villette did its work swiftly, admirably, and cleanly. I recognize in both types of machines new servants to be used for the benefit of the gas industry and the community, and I wish the makers of both machines all possible success. But I do not forget the Magician's cry of "New Lamps for Old;" and the foundations of inclined retorts remain unshaken.

THE BERMONDSEY CLAUSE AND MUNICIPAL TRADING.

By VINCENT R. BALFOUR-BROWNE, B.A. [Oxon], of the Middle Temple, Barrister-at-Law.

In the "Times" for the 23rd of May, there was a report of the proceedings on a Private Bill promoted by the Willesden Borough Council,* before a Committee of the House of Lords presided over by Lord Brougham, which suggests some important considerations.

Public attention has been directed a good deal of late to the matter of municipal trading; and the Bill in question, and the proceedings referred to, are interesting in this connection. Whatever may be said in favour of entrusting industrial enterprises to the hands of corporations, there does seem to be a great deal to be said against allowing the unfair competition of municipal bodies, who can fall back upon the rates, with the private enterprises of companies and individuals, who, so far from having rates behind them, can be taxed for the benefit of their municipal rival. It was this point that was emphasized by the decision of Lord Brougham's Committee; and some notes on the matter may have some interest for your readers.

In 1902, the Bermondsey Borough Council brought up for confirmation by Parliament an Order for extending their powers. The Council seem to have had an Order which enabled them to supply electricity in part of their area. But in the district of Rotherhithe, an Electric Lighting Company had, in the year 1888, obtained power to supply current. It seemed from the opening of Counsel that the Company had done very little with the powers given them, and that there was a necessity for a further and better supply in the Rotherhithe district. The Order of 1902 was to enable the Borough Council to purchase the Company's undertaking, such as it was, in Rotherhithe—a provision which was forced on the Council by the Board of Trade—and to enable the Council themselves to supply electricity in that part of the district.

The South Metropolitan Gas Company petitioned against the confirmation of the Order, and stated in their petition that "their property differed from the ordinary rateable property of the borough, and their interests differed materially from the interests of the owners and ratepayers of the borough, as they derived no advantage from the objects to which the rates of the borough are applicable, and were specially affected by the provisions of the Bill and Order." They stated, further, that the Company were among the largest ratepayers in the borough; the rateable value of their property being £17,942, and the amount contributed by them towards the rates approaching £8000 per annum. Under these circumstances, they opposed the unfair competition which would be set up in Rotherhithe if the Order was confirmed, upon the quite intelligible ground that if the Council made the undertaking pay, it would probably be only at the expense of the Company's revenue, but that if the Council failed to make it pay, the burden of the rates would be increased, and the Gas Company would be called upon to pay for the unfair competition which would be set up in consequence of this municipal trading.

Sir Ralph Littler, who appeared for the Borough Council, objected to the *locus standi* of the Gas Company; but the Lords Committee [Lord Fermanagh (Earl of Erne) sat as Chairman] decided that they would hear the Company, and in the event adopted the clause which had been brought up by the South Metropolitan Gas Company. The clause runs as follows:—

> The undertakers shall, once in every year after the first year's working of the undertaking, cause to be laid before them a statement and balance-sheet of the accounts of the undertaking, drawn up in accordance with the form of accounts prescribed by the Board of Trade for a local authority under the Electric Lighting Acts 1882 and 1888; and the undertakers shall thereupon fix annually the charges to be made for the supply of energy in the then ensuing year, at such rates [not exceeding the maximum rates specified in their Order] so that, as far as is reasonably practicable, the revenues of that year shall not be less than the expenditure of that year.

The obvious intention of this clause was to compel the Borough Council to work their electrical undertaking on commercial principles, and to prevent the municipal body from having recourse to the rates to aid their unsuccessful undertaking.

This was the first time that this important principle had been applied to an electric lighting enterprise in public hands. But the same Committee, at the instance of the South Metropolitan Gas Company, put the same clause in an Electric Lighting Order for the Borough of Woolwich; and a precisely similar clause was put into the Order which was brought up for confirmation by the Metropolitan Borough of Stoke Newington. This "Battle of the Giants," as an after-dinner speaker called it not long afterwards, has peculiar interest at the present time. But it is right to point out that a somewhat similar duel had already been fought out between "Giants" like the North British and Caledonian Railway Companies on the one hand and the Corporation of Dundee on the other.

In the year 1898, the Corporation of Dundee applied for power to take over the Dundee and Broughty Ferry Tramways; and they were opposed by the two Railway Companies mentioned. The opponents pointed out to the Committee of the House of Commons that the tramways in question ran parallel to their railways—that they did as a fact compete for traffic with the railway lines; and what they feared was that if the Corporation became the owners and workers of the tramways, they might carry at low unremunerative fares, and take the traffic away from the railways, and pay for the loss they made over their tramways out of rates, to which the Railway Companies would have to contribute. In this way, the Railway Companies would have to pay for being deprived of their own traffic.

The Committee took the view that that was an eminently unfair proposal, and inserted a clause* to the effect that—

> The Corporation shall, once in each year after the first year's working, cause their Treasurer to lay before them a statement and balance-sheet of the tramway accounts, including the reserve and suspense accounts for the preceding year, and an estimate of the revenue to be derived for the ensuing year from the working and use of the tramways and carriages and trucks thereon, and also an estimate of the sums required to meet for such year the expenses of working, management, maintenance of lines, works, machinery, and rolling stock, repairs, renewals, materials, wages, taxes, and other outgoings and charges, including allowance for depreciation and also the interest on borrowed money and the payment of the sums required to be annually made to the sinking fund; and the Corporation shall thereupon fix annually the tolls, fares, and charges to be levied by them for the use of the tramways, and of carriages and trunks used or propelled thereon, for the said year then ensuing, not exceeding the tolls, fares, and charges specified in the Tramway Acts, so that the revenue shall meet the expenditure as before specified for each year. Provided that if in any year the revenue exceeds such expenditure, the Corporation shall carry such excess to a reserve account to be used in providing for deficiencies and contingencies, and that should there be a deficiency in any year it shall be provided for in the estimate for the following year by drawing from reserve account, or varying the tolls, fares, and charges, or reducing working expenses, or be carried to a suspense account and reduced gradually over a period of years not exceeding five. Provided also that, in making the estimates aforesaid and balancing accounts at the end of such year, the depreciation on machinery and plant shall be at the rate of 3 per centum on the first-cost thereof.

A similar clause was also inserted in an Aberdeen Corporation Tramways Bill of the same session.† In these, it is obvious that precisely the same limitations were put upon the Corporations in relation to their trade as carriers of passengers as was put upon the Bermondsey Borough Council in relation to their enterprise in the direction of generating and supplying electricity for lighting and power. But perhaps the restriction is more important in connection with the latter than with the former. Tramways which are worked by electricity have proved wonderfully successful, both in the hands of companies and corporations. Electric lighting undertakings have, in municipal hands, in many cases turned out disastrous failures.

At the inquiry into the Bermondsey Order of 1902, it appeared that in the town of Kingston the Corporation were making a loss. They had 6000 ratepayers, and they were only selling to 400 consumers of electricity. So that the 6000 ratepayers (or the 5600) who got no benefit had to pay for the luxury-light of 400 persons. It also appeared that Salford, which was exploiting

* See "JOURNAL," May 26, p. 530.

* Dundee and Broughty Ferry Act, 1898. Sec. 25.
Also Dundee Gas, &c., Act, 1899. Sec. 30.

† There was, I believe, a somewhat similar clause introduced into a Rochdale Corporation Tramway Bill of the following session; and in the Rhondda Urban District Council Tramways Bill, 1902, a clause was inserted compelling the Council to lease their tramways to a Company.

electric light, was charging a loss of £7800 on its 36,000 ratepayers, for the benefit of some 400 people who were supplied with electricity. In the Willesden case, Counsel for the Gaslight and Coke Company said he had a list of 50 or 60 undertakings in the hands of corporations, some of which had been carried on for five, some for seven, some for nine, and one for twenty years, where the corporations were making a loss. Among these, Hastings, Bedford, Blackburn, and Leyton were mentioned as Corporations which were still working their undertakings at a loss.*

The next curious phase in connection with the attempt of local authorities to make their undertakings profitable at the expense of their rivals, may be noted in connection with the Woolwich Corporation Bill of the present session. The borough had had the Bermondsey clause put upon them last year. In the present session they promoted a Bill to authorize them to provide fittings and apparatus free to persons proposing to take energy. This was an ingenious method of coaxing the gas consumers away from the mains of the Gas Company, and getting them attached to the electric cables of the Council. A similar clause had been inserted in the London County Council Bill of this session, but had been struck out in the House of Commons on the second reading. But here was the enterprising Borough of Woolwich attempting to do the same thing. The South Metropolitan Gas Company petitioned against the Bill on the ground that the clause in question would enable the Borough Council to compete unfairly with them, and charge the expense of the free-given fittings on the rates, contrary to the intention of Parliament in the session of 1902. The Borough Council objected to the *locus standi* of the Gas Company, which means that they wanted to prevent them being heard to say that the Council should not compete with them in this unfair way. The Court of Referees in the House of Commons allowed the *locus;* and I believe that the clause in question is no longer part of the Borough Council Bill.

We now come to the last attempt to induce Parliament to allow this unfair competition; and, as I have indicated, that was in connection with the Willesden Urban District Council Bill of this session. Willesden has already spent about £63,000 upon its electric lighting undertaking, and up to the 22nd of May was not supplying energy at all. The Bill proposed to allow the Council, with the approval of the Local Government Board, to borrow further moneys for this electrical undertaking; and the Act contained some clauses which, in the opinion of the Gaslight and Coke Company, were very objectionable. The clauses were as follows:—

9.—Where the Local Authority of any district adjacent to any part of the district desire to be supplied with electrical energy by the Council, such Local Authority (if themselves authorized to distribute electrical energy under any Act or Order confirmed by Parliament) may apply to the Council intimating such their desire, and thereupon the Council may supply to the Local Authority, and such Local Authority may take from the Council, electrical energy in bulk, at or near the boundary of the district, on such terms and conditions and in such manner as may be agreed between the Council and the Local Authority.

10.—The Council on the one hand, and any Local Authority, company, or person owning or working any tramway, tramroad, railway, or light railway partly within and partly without the district on the other hand, may enter into, and carry into effect, agreements for the supply by the Council of electrical energy to such authority, company, or person for the purposes of which such authority, company, or person is empowered to use the same.

12.—(1) The Council may purchase, provide, supply, sell, let, use, and otherwise deal in, fit up, fix, alter, repair, remove, and refix (but shall not manufacture) electric lines, fuses, switches, fittings, meters, lamps, lamp-holders, motors, and other apparatus incidental to, or connected with, the use or used in, the supply of electrical energy, and may provide materials to do all work necessary or proper in that behalf, and may take such remuneration, rents, or charges, and make such terms and conditions with respect to such supply, sale, letting, using, fitting, fixing, altering, repairing, or removal, or refixing of such apparatus, or the provision of such materials, or the doing of such work, and for securing the safety and return to the Council of articles and fittings let and otherwise as may be agreed upon between the Council and the persons to or for whom the same are supplied sold, let, fitted, fixed, altered, repaired, removed, refixed, provided, or done. (2) No electric line, fuse, switch, fitting, meter, lamp, lamp-holder, motor, apparatus, or thing let for hire by the Council shall be subject for distress, or to the landlord's remedy for rent, or to be taken in execution under any process of law or equity, or any proceeding in bankruptcy, against the person or persons in whose possession the same may be, provided that such electric line, fuse, switch, fitting, meter, lamp, lamp-holder, motor, apparatus, or thing is marked or impressed with a sufficient mark or brand indicating the Council as the actual owners thereof.

The promoters attempted to distinguish their case from the Bermondsey case by saying—what seems to have been true—that in the latter Bermondsey was seeking to supply, under their Order, in Rotherhithe a district they had not supplied before, although a company had supplied inefficiently; but that in the Willesden case they had already got the power to supply electricity, and that therefore the case was distinguishable. The complaint of the Gas Company was the same in this matter as it had been in the Bermondsey Order. They objected to the District Council trading against them and taxing them to carry on that rivalry. They also pointed out that the large powers asked for by sections 9 and 10 would enable the Council to enter into extensive business outside their own area, contrary to the true idea of municipal functions, and that if they made a loss in such speculative ventures, the Gaslight and Coke Company, who had rateable property in the district worth £8374, and paid in the district £2631 in rates in the year, would inevitably suffer.

It is obvious that this is a vital matter for gas companies. If this sort of thing is to be allowed in Willesden, it will be allowed all over the district at present supplied by the Gaslight and Coke Company—a Company that has 350,000 consumers, pays £140,000 a year in rates, has property extending to 800 acres, a staff of 6000 officers and servants, 2000 miles of mains, and is under an obligation to supply gas. But the matter was discussed in the Committee of the House of Lords, with the result that their Lordships decided in the following words: "We have divided our decision into three heads. In the first place, we are of opinion that the Willesden Urban District Council should not supply energy outside its boundaries. As regards the electric fittings, we are inclined to think that clause 12 should remain as it is in the Bill, and then you wish for the insertion of a clause similar to the clause in the Bermondsey and Stoke Newington Bills with regard to the annual statement of the balance-sheet and accounts." On a subsequent day, a clause was brought up and inserted in the Bill to the following effect:—

The undertakers shall, once in every year after the first year's working of the undertaking, cause to be laid before them a statement and balance-sheet of the accounts of the undertaking, drawn up in accordance with the form of accounts prescribed by the Board of Trade for a local authority under the Electric Lighting Acts 1882 and 1888; and the undertakers shall thereupon fix annually the charges to be made for the supply of energy in the then ensuing year, at such rates [not exceeding the maximum rates specified in their Order] so that, as far as is reasonably practicable, the revenues of that year shall not be less than the expenditure of that year.

It is somewhat curious, and shows the necessity for some such protection as that which was asked for by the Gaslight and Coke Company, that, on the very same day a Committee of the House of Commons had before them the South Shields Corporation Bill, which was being opposed by the Gas Company on somewhat similar grounds. In the course of the inquiry, it transpired that the Gas Company, which had been long established, complained that the Corporation, with the view of taking away their customers and so getting customers for the Corporation's energy, had made an offer to supply, for three months, all persons who would take electricity, without making any charge at all. It was, in the picturesque language of some members of the Corporation, said to be "A sprat to catch a mackerel." And no doubt that is an economy in fishing; but it is a little hard if you make the man who has already hooked the mackerel pay for the sprat with which you are going to take away his mackerel.

In that case, too, evidence was given that, although the accounts purported to show a profit in relation to electricity in the year 1892 of £2110 13s. 10d., if it had been worked on commercial principles, the accounts would have shown a loss of £17,391. This is, I think, another excellent illustration of the necessity of some such protection as that which has been asked for and given in the cases referred to.* But it is a matter which all the Corporations and Urban District Councils who desire to trade in electricity ought seriously to consider. Can they trade under such clauses as those referred to? The idea that if a tramway does not pay at penny fares, it is to be the duty of the corporation to increase the fares next year to 2d., seems a little crude. The real way to make an electrical enterprise pay is not to increase charges for electricity, but to reduce them; and by means of the clauses in question, the corporations to which they have been applied are prevented taking the only course which ordinary and wise traders would take. Of course, if the corporation can make its undertaking pay, then the clause will do it no harm, although, in fairness, it would seem that if they make any profit out of electricity, it ought not to go to the benefit of the ratepayers generally, and therefore to the gas company among them, but solely to the benefit of the consumer of electricity, in reducing the price of the commodity supplied. But I do not find that any provision has been made in this direction, although I cannot doubt the fairness of supplementing what has been called the "Bermondsey Clause" by another.

* Of course, everyone is familiar with the deadlock which has arisen in connection with the purchase, by the Marylebone Borough Council, of the undertaking of the Metropolitan Electric Supply Company within the borough. Under the award of Mr. C. A. Russell, K.C., the Council have to pay £1,212,000, and have not yet paid the money. It is said that the raising of the money will involve the ratepayers of Marylebone in a very heavy rate in the pound for many years to come.

* A similar clause to the Dundee and Broughty Ferry Clause was inserted in the South Shields Corporation Bill on May 27, 1903.

FANS IN GAS-WORKS.

(*Concluded from p.* 445.)

By R. Gordon Mackay, Assoc.M.Inst.C.E., Member of the Berlin Section of the Society of German Engineers.

Part VI.—Ventilation.

Although it was stated in Part I. of this article that there must be a clear distinction between a fan and an air-propeller, so often is the former term applied to the latter machine that a short account of the air-propeller will conclude this little treatise.

The air-propeller is without doubt the simplest of all air-moving machines, and in a primitive form may be made by rotating a piece of cardboard around a fixed spindle; the cardboard being set at

such an angle to the plane of the machine as to cause an axial movement of the air medium on which it works. The reason of the inefficiency of the air-propeller has long been a subject of inquiry among engineers; and although there are many of these axial-flow air-moving machines made and installed and moving large quantities of air, it is an undisputed fact that from 70 to 80 per cent. of the work put into the machine is wasted by swirling eddies and friction of the bearings. For many years, it has been an acknowledged fact that the blades of the air-propeller are not altogether of great importance in moving the air, as almost as much air is moved with two and three blades as with four, six, and eight blades—in fact, it appears that many blades are not only so much excess metal in the revolving mass, but actually stand in the way of each other. Simplicity and mechanical construction are two important features of the propeller, although, perhaps, the most important for its successful working is its correct application.

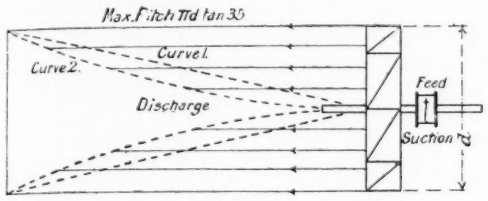


FIG. 23.

A glance at fig. 23 affords a ready means of understanding the peculiar motion of the air through the plane of the propeller, and the difficulty of calculating the volume of air passed through; and it is strange that, with such a simple-looking contrivance, how much practical knowledge is needed before an engineer can gauge its performance to any required degree of accuracy. The theoretical velocity of the air passing through the plane of the propeller is obtained by multiplying the revolutions by the pitch of the blade. The propeller blade under consideration in the sketch is supposed to be at 35° to the circular plane of rotation, and therefore, since the pitch or axial movement of the air is circumference X tan 35°, the velocities of the air vary from zero at the centre to a maximum value at the periphery of the propeller. With a machine of constant angle, the theoretical air displaced by one revolution is therefore practically ⅔ of a cylinder of base equal to plane of propeller, and height equal to maximum pitch. This, of course, is with inlet and outlet quite free. It follows that if a resistance to the axial flow be offered, a large part of the air returns through the middle or weak part of the machine. The air-propeller as made invariably has a central disc, which in some may be proportionately increased as it is required to move air against appreciable back-pressures. The angle of the blade also is often increased as the blade approaches the centre, thereby giving a curve of velocity of nearly the shape marked curve 2 in the diagram.

The reason of the limit of speed generally adopted by air-propeller makers is rather amusing, although it appears to answer fairly well in practice. But some time ago, it was acknowledged that a cast-iron fly-wheel should not run at a number of revolutions exceeding a peripheral speed of over 6000 feet per minute. One seldom sees cast-iron air-propellers; but nevertheless the top speeds are all approximately given from this formula,

$$\pi\, d\, N = 6000$$

where d = feet diameter
N = revolutions per minute.

Thus, an 18-inch diameter air-propeller seldom runs over 1200 revolutions per minute, and a 72-inch at about 320 revolutions per minute. But such a rule is altogether misapplied; for as far as peripheral strength is concerned, the ring-bound propeller might be run at far higher speeds, if strength alone ruled the running. The ruler of successful running, however, is the attempted avoidance of the bugbears called slip and swirl, which are the castles "Doubting" and "Dangerous" of the manufacturer.

The maximum theoretical velocity of the air passing through the propeller (see fig. 23) is obtained from the formula

$$\pi\, d\, N \times \tan 35$$

for the pitch is equal to $\pi\, d \times \tan 35°$. But since in general $\pi\, d\, N = 6000$, the maximum velocity of air near the periphery of the air-propeller is approximately 4200 feet per minute. The actual velocity is, of course, this less the slip—often a very considerable percentage, especially with much higher speeds. The maximum value of the pitch is $2{\cdot}2d$, and the minimum value is zero; and since the mean pitch is two-thirds the maximum, or about $1{\cdot}45d$, the theoretical volume becomes

$$(0{\cdot}7854\, d^2) \times 1{\cdot}45d \times N = 1{\cdot}14\, d^3\, N.$$

But even with free inlet and outlet, the slip of the air and reduced area due to blades would nullify about 40 per cent. of this; so that the volume passed through becomes actually only $0{\cdot}684\, d^3$ N approximately, where d is, of course, reckoned in feet and N is the revolutions of the propeller. Such a formula is usefully applied for ventilating purposes; and as the air propeller is rightly applied only for the purpose of moving volumes of air against insignificant back-pressures, it is unnecessary to lay down another formula for the central disc application, although such a one is easily arrived at.

The volume curve on fig. 6, Part I., gives the asymtotic or maximum possible value of the air moved by a centrifugal fan as

$$0{\cdot}65 \times o \times u \times \sqrt{2k}$$

but since $o = \pi dW$
and $u = \pi dN$
and K the monometric yield may be taken for a radial vane as 0·80, the formula becomes

$$0{\cdot}65 \times 1{\cdot}26 \times \pi^2 d^2 NW \text{ or } 8d^2NW \text{ approximately.}$$

So that a wheel discharging the air centrifugally can give as large a volume when running without spiral casing when $8W = 0{\cdot}68d$; the wheel, of course, being provided with two inlets. The writer merely mentions this fact because so many are labouring under the delusion that a fan-wheel discharging centrifugally cannot deliver as much air as an air-propeller discharging axially.

The above figures are given upon the consideration that the centrifugal fan-wheel has two inlets of a diameter equal to the wheel diameter—*i.e.*, a very open passage through the wheel. The author has himself measured $2{\cdot}5d^3N$, as the air quantity given by a fan-wheel, on these proportions, enclosed in casing—viz., a 28-inch wheel running at 960 revolutions per minute gave about 30,000 cubic feet per minute.

From an engineering point of view, the mechanical efficiency of the centrifugal fan, though sometimes as large as 65 per cent., is very unsatisfactory; but the ratio of useful work to work put into the machine with air-propellers is shockingly low, seldom or never being above 25 per cent., and in many cases as low as 15 per cent. Take for instance, a 60-inch air-propeller at 400 revolutions per minute.

Volume moved $= 0{\cdot}68\, d^3\, N = 34{,}000$ cubic feet per minute
Average velocity = 1920 cubic feet per minute;

but since

$$h = \frac{v^2}{2g} \cdot \frac{\gamma}{\gamma^0} \cdot \frac{459 + to}{459 + 32} 12 = \frac{v^2}{3930}$$

when t is 60° Fahr. and when moving air where v is 32 feet per second and h is water-gauge equivalent, or 0·26". The horse-power in the air is therefore

$$\frac{34{,}000 \times 0{\cdot}26 \times 5{\cdot}2}{33{,}000} = 1{\cdot}39$$

whereas the horse-power required to drive same is nearly 5, or a mechanical efficiency of

$$\frac{1{\cdot}39}{5} = 27{\cdot}8 \text{ per cent.}$$

This efficiency will decrease if a back-pressure be put upon the air-propeller. Such figures cannot strictly be applied to every type of air-propeller, although air-propellers running free do not differ very much in the quantity of air delivered. The surface of the blades has some influence on the power absorbed; the less the surface required, the better from every standpoint.

There are many cases where the axial flow propeller has been applied to bettering the peculiarly bad state of atmosphere almost always existing in the retort-house. Some gas-works have been unexpectedly surrounded by tenements, and have become practically ingested into suburban branches of what were once more or less distant cities, with the result that the dust and smoke from the retort-house can no longer be trusted to find their way into the atmosphere for further natural dessimation into the upper and lower strata of the air we breathe. The drawing off of the vitiated air and dust is not a very difficult matter; but many difficulties are met when once it is attempted to settle and collect the dirt and dust passed through the air-propeller.

In purifying sheds, especially when partially closed in by walls and roof, the process of opening for removing the spent oxide of iron or the lime necessarily causes an emission of unpleasant odours, and a stream of fresh air passing through the purifying-house and over the revivifying floors is a decided boon.

In concluding this little treatise on "Fans in Gas-Works," the writer hopes that many of the gas engineers who weekly look through the pages of the "JOURNAL" may have found time to have made some gleanings from the rich harvest of facts and formulæ relating to these air and gas moving machines. Though the fan engineer's branch of the great profession of civil engineering is one which so few have cared to trouble about, yet of late years there have risen men, both in England and on the Continent, who are no longer content to work in the dark, and to whom, perhaps, this short work may be of more especial interest. The writer offers no apology for the short mathematical portions indulged in, because there is no class of engineers more able to talk mathematics and physical problems, and even fire off calculus, than the gentlemen at the heads of the various gas-works, and their able lieutenants.

TECHNICAL RECORD.

GERMAN ASSOCIATION OF GAS AND WATER ENGINEERS.

Annual General Meeting at Zurich.

The Forty-third Annual General Meeting of this Association was held last week at Zurich, under most favourable conditions in respect of weather, which, combined with an attractive programme of entertainments and excursions, made the gathering a memorable and highly enjoyable one. The technical matter presented to the meeting was likewise of a high order, though one or two of the papers read contained little that has not already been laid before the readers of the "JOURNAL" in the course of the past twelve months. Nevertheless, it may be rightly stated that so good a series of communications has rarely been offered at any meeting of gas engineers in England; and it was to be regretted time did not admit exhaustive discussion of their contents.

The attendance was excellent, thanks in some measure to the Swiss Association of Gas Engineers having decided to hold their annual meeting this year in conjunction with the German Association. Over 650 members and technical men participated in the meeting; and there were further a very large number of lady visitors, who brought up the total attendance at some of the functions to upwards of 1000. The opening ceremony was a reception on the evening of Tuesday, the 23rd inst., held in the pavilion of the magnificent "Tonhalle," or Concert Hall, of Zurich. The gathering was large; and the greatest enthusiasm prevailed. Supper was served in the pavilion, while the orchestra played selections on the terrace. After dark, there was a good display of fireworks in the grounds of the "Tonhalle;" and the members then gradually dispersed, to await the serious business of the meeting, which began on Wednesday morning.

Before passing on to an account of the business, it may be profitable to devote a few words to the organization and arrangements which go so far to make the meetings of the German Gas and Water Association unqualified successes. A Local Committee are entrusted with these matters; but substantially the same lines appear to be followed year after year. The general scheme seems to be modified only so far as the local conditions render modification essential. Experience has proved that the scheme is a good one, and any great departure from it might court disaster. Briefly, it may be said that at the outset one of the finest assembly halls in the place is secured for the technical meetings, which extend over three days. At Zurich this year, as at Vienna two years ago, the hall in question was a magnificent concert-room, well ventilated, well equipped, and superbly decorated, having seating accommodation for 500 and more. The use of smaller halls and salons under the same roof is secured for the display of drawings, models, and novelties in connection with gas and water supply. Anything likely to be of interest to gas engineers is freely accorded space; so that at any time when the communication which may happen to be in progress in the hall is not directly interesting to any member, he may usefully occupy himself with an inspection of the exhibits, &c. The official bureau, at which members apply for tickets and information, is also usually established in the entrance hall of the building.

Tickets, at an inclusive charge of about £1, covering all the functions and excursions of the meeting, have to be applied for in advance, and are then issued from this bureau. They are embodied in a small book, which gives all particulars of the times and places of assembly, both for the meetings proper and the special functions for ladies, which are planned for the hours when the technical programme demands the attendance of the sterner sex. The tickets themselves are withdrawn from this book, by breaking off at perforated lines, as each occasion arises. The book further contains a list of the privileges extended to members on exhibition of the artistic badges which are issued with the tickets. These privileges are often of a most valuable character, and one's wonder is aroused as to the manner in which they have been secured. In Zurich last week, for instance, the badge gave its wearer the right to travel free on any of the tram-cars which traverse the city in all directions, and are in some parts worked by the Corporation and in others by a private undertaking. It likewise gave free access to the concerts in the "Tonhalle" and to a large number of the museums, galleries, &c., which abound in the industrial capital of Switzerland. Furthermore, the book of tickets contained an insurance coupon for 10,000 frs., payable in the event of the death or disablement of the holder during the four days over which the meeting extended. Reduced railway fares to places of interest in the neighbourhood are also granted to wearers of the badges. These privileges go far to render the meeting attractive to many who would not attend merely to hear a number of papers read, which they can afterwards peruse, under conditions more favourable for their proper study, in the "JOURNAL" or its German contemporary.

The special functions for which tickets are included comprised, at Zurich last week: Supper at the reception on Tuesday; railway journey to and from the Corporation gas-works at Schlieren, with refreshments, on Wednesday afternoon; a trip to a well-known rural resort, where a concert was given in the evening; and a steamer run of about 30 miles on the Lake of Zurich on Thursday afternoon, including refreshments on board, and a meal at a picturesque island resort. The banks of the lake were well illuminated at the time of the return of the steamer. Finally, there was a banquet on no mean scale on the Friday evening. All these good things were afforded those who attended the meeting, in consideration only of a subscription of about £1 per head. Clearly, only the most perfect organization could secure so much for members of any body; and, moreover, even this would fail to accomplish it were the attendance considerably reduced. Herein may be found the secret of much of the success which of late years has invariably attended the meetings of the German Gas and Water Association. Even many incidental expenses are incurred of which no mention has been made—for instance, on each day lists are printed and circulated to those attending the meeting, giving the names and addresses of all who had arrived in the city up to the preceding evening. Thus members are able to keep in touch with one another in a way which would otherwise be impossible with such large numbers.

Very much of the German programme might be studied with advantage by the organizers of similar gatherings, whether of gas managers or others, in England; and for this reason we have given on the present occasion somewhat full details of it. It should be added that the programme at Zurich was carried through without the slightest hitch, and that the weather, which had been unkind during the sittings of the International Photometric Committee a few days earlier, was superb throughout.

The business proceedings commenced at 9 a.m. on Wednesday, in the large salon of the "Tonhalle." Over 600 were present in the course of the morning. The President of the German Association (Herr Beer, the Manager of the Municipal Water-Works of Berlin) opened the meeting with a few words of thanks to the authorities of Zurich, and to the Swiss Association for their co-operation. The President of the City Council (Herr Pestalozzi) replied for the authorities, and welcomed the members in a speech in which he incidentally referred to the enormous development of Zurich as an industrial centre during the last decade, and to the success which had attended the Corporation enterprises for the supply of gas, water, and electricity. The three undertakings yielded during last year a net profit of 1,234,000 frs., after writing off loan capital at the rates of 4, 3, and 5 per cent. respectively for the gas, water, and electricity works. Privy Councillor Lutz next spoke a few words of welcome to the Association on behalf of the Cantonal Government. He referred to the magnitude of the questions of which the Association made study, to the development of schemes for utilizing water power in Switzerland, and to the social problems incidentally involved in the management and conduct of lighting and power undertakings. Herr Rothenbach, of Berne, made a short speech on behalf of the Swiss Association of Gas and Water Engineers.

The technical proceedings on the opening day included short descriptions of the Zurich Gas, Water, and Electricity Works by the respective Managers and Engineers, Herren A. Weiss, H. Peter, and H. Wagner. A full description of the very interesting gas-works designed by Herr Weiss has already been given in the "JOURNAL" and reprinted in pamphlet form. A similar account of the works in German, fully illustrated and neatly bound, was presented to each member of the Association. The works were visited in the afternoon, and the stoking and conveying machinery was seen in operation and much admired. Professor Zschokke gave an interesting lecture on the development of schemes for utilizing water power in Switzerland, for which he predicted great success. Next Herr Wunder, of Leipsic, and Professor Bunte, of Carlsruhe, gave addresses on the industrial value of gas coal; the one speaking from the standpoint of the practical user of coal for gas making, and the other from the chemists' point of view. The information furnished referred, of course, primarily to German coals; but incidentally it should prove valuable to English gas people. The Swiss technical men present at the meeting were greatly interested in these addresses, because of the dependence of Switzerland on Germany for its supplies of coal and briquettes, and of projected arrangements for testing all imported fuel as to its calorific value as it enters the country. It is estimated that, with proper arrangements for sampling, exhaustive testing of the imported coal and briquettes will not cost as much as 1d. per ton.

The second day's sitting opened at 10 o'clock; members having earlier in the morning had an opportunity of visiting the city water and electricity works. Herr Körting gave, in conjunction with Mr. Edward Drory, an account of the Mariendorf works of the Imperial Continental Gas Association at Berlin. These works have already been fully described in the "JOURNAL" by Mr. Drory; and a similar illustrated account of them in German was distributed at the meeting. Then followed a description of the reconstruction of the Crefeld Gas-Works by the Manager, Herr Salzenberg. These papers gave rise to an interesting discussion as to the relative merits of the system of inclined retorts as used at Mariendorf, and of horizontal retorts when stoked by West's machinery, as adopted at Crefeld.

The following paper was one by Dr. Erlwein, of the firm of Siemens and Halske, of Berlin, on the "Sterilization of Drinking Water by means of Ozone." It aroused a considerable amount

of interest among the water engineers present. Herr Meier, of Gerlafingen, followed with an account of the installation of high-pressure cast-iron water-mains, and the apparatus incidental thereto. Professor Renk, M.D., of Dresden, was unable to attend to deliver his projected lecture on "The Hygienic Aspects of Gas Lighting;" but Dr. Schilling, of Munich, gave the substance of it to the meeting. It referred to the effects of different forms of artificial lighting on the eyesight and on the atmosphere of rooms; and the information was so far brought up to date as to cover high-pressure incandescent gas lighting.

After this lecture, the reports of the various Technical Committees of the Association were read and approved, and the necessary grants for furthering the continuance of their work were made. These reports are in some cases of a very interesting character.

On Friday, the sitting opened at 9.30 a.m., and the remaining items of the programme of the meeting were proceeded with as rapidly as possible, in order to clear off the rather heavy list of arrears. Dr. A. Steger, of Amsterdam, read a valuable paper on water gas, with special reference to the process of Drs. Kramers and Aarts. A series of articles by Dr. Kramers with reference to this system has been given in our pages; but Dr. Steger brought the information as to the practical developments of the process up to date. Herr Rothenbach, of Berne, then described the gas-works of St. Margrethen, in Switzerland, which supply gas by means of high-pressure mains to a number of scattered communities in the Swiss mountains. An account of this interesting development of gas supply has appeared in the "JOURNAL." A short paper by Herr Burgemeister, of Celle, on "Purification," was next given; and Professor H. Aron, of Berlin, delivered a lecture on "Prepayment Meter Apparatus."

The meeting then proceeded to transact the private business of the Association, and to elect a President and other officers for the ensuing year. The elections resulted in the unanimous choice of Herr Körting, of Hanover, as President, and of Hanover as the place for next year's gathering of the Association. The meeting concluded, as already mentioned, with a most successful banquet at the "Tonhalle."

MANCHESTER AND DISTRICT JUNIOR GAS ASSOCIATION.

Visit to Wilmslow.

Members of the above-named Association had an interesting, and very enjoyable, excursion on Saturday last to Wilmslow, where Mr. William Severs, the Engineer and Manager of the Wilmslow and Alderley Edge Gas Company, had not only placed his own works at the disposal of the members for unrestricted inspection, but had also arranged with Mr. T. Molyneux, Assoc. M.Inst.C.E., the Water Engineer of the Stockport Corporation, for an examination of the softening plant at their Wilmslow subsidiary pumping-station.

The party, which numbered about 25, reached Wilmslow shortly before three in the afternoon, and were met by Mr. Severs, who first conducted them to the water-works, where they were received by Mr. Molyneux, who had made special arrangements for showing and explaining the various processes connected with the water-softening plant. As this process was fully described in a paper read by him before the British Association of Water-Works Engineers last year, and duly noticed in the "JOURNAL" (see Vol. LXXX., p. 1692), it is not necessary to enter into any detailed description of it. The members were much interested in the practical demonstrations of the methods adopted for softening the water, the hardness of which is reduced from 13° to about 5·5° and 6° at a cost of 1d. per 1000 gallons. Mr. Molyneux explained that one great advantage of the system was that it was under absolute control—a certain quantity of water being treated by a given bulk of lime; and if an error were made during any part of the process, it could be immediately detected or rectified, or if beyond rectification, the water could be separated or wasted if necessary.

At the conclusion of the visit, Mr. Hill (Stalybridge) said they had all been very much interested, and he was sure instructed, in what they had seen. He had great pleasure in proposing a vote of thanks to Mr. Molyneux for the opportunity afforded for visiting the works, and for the trouble he had taken in explaining and demonstrating the various processes in use. Mr. Garlick, in seconding the proposal, said that although the works they had seen were perhaps outside the range of their general avocation, they had had a very valuable opportunity of increasing their knowledge in connection with a kindred branch of engineering. The vote of thanks having been heartily accorded, Mr. Molyneux, in responding, said he had been only too pleased that the opportunity had been afforded of showing the members round the works, as what they had learned themselves they were willing to communicate to others.

The party next proceeded to the Wilmslow Gas-Works, where they were shown over all the departments by Mr. Severs and his assistants. In a short description he had prepared for the special information of the visitors, Mr. Severs stated that the works were originally owned by the late Mr. William Bower, who more than fifty years ago introduced gas to light up his cotton-mill. He at first supplied the public at 4d. per light per week; but he subsequently introduced meters, and charged 8s. per 1000 cubic feet. In 1864, the works were taken over by the Wilmslow and Alderley Edge Gaslight and Coke Company. At that time, the make of gas was not known, as there was neither station meter nor governor—the pressure being regulated simply by weights on the gas-holder. The new Company, however, felt justified in reducing the price to 7s. When Mr. Severs took charge of the works in 1896, the production of gas was 28,621,800 cubic feet per annum. At the end of last March, it had been increased to 51,412,000 cubic feet. The present carbonizing plant consists of four beds of eight and two of six retorts, each 22 in. by 15 in. by 10 ft., heated on Drake's regenerator principle. The condensers consist of nine 8-inch pipes in an overhead water-tank. The engines and exhausters were made by Messrs. R. & J. Dempster, Limited, and Messrs. George Waller and Co.; the former having a capacity of 7000 cubic feet per hour, and the latter (a three-blade) 20,000 cubic feet per hour. When the boiler is being cleaned, a Crossley gas-engine, with fast-and-loose pulley, is employed to drive the small exhauster. Two scrubbers are used, for liquor and fresh water respectively; the latter, in which is fixed a Livesey washer, having been erected in 1896 by Messrs. R. & J. Dempster. There are four purifiers, each 18 ft. by 18 ft. by 5 ft. 6 in., which are on Green's system. They were put down during 1900 by Messrs. R. Dempster and Sons, Limited. The station meter, one of Braddock's, is of 15,000 cubic feet per hour capacity. There are two holders capable of containing respectively 111,000 and 67,000 cubic feet of gas. The smaller holder, which is on the Gadd and Mason principle, and was erected by Messrs. R. & J. Dempster in 1894, Mr. Severs stated, has worked exceedingly well. One of Parkinson's equilibrium governors with 12-inch inlet and outlet pipes is used. Some particulars as to the commercial progress of the Company under Mr. Severs' management were also given by him.

At the close of the inspection, the members were most hospitably entertained. It transpired later on—although the fact had been kept back by Mr. Severs—that the day of the visit was his twenty-fifth anniversary as a gas-works manager; and congratulations on the event were hearty and numerous.

Before terminating the proceedings, Mr. Hill said he was quite sure the members would all wish to testify their high appreciation of the manner in which they had been received; and he had great pleasure in proposing that their warmest thanks be tendered to Mr. Severs, as well as to Mrs. Severs and her daughters who had so zealously looked after their creature comforts. Mr. Berry, in seconding the proposal, remarked that they had also to thank Mr. Severs for the arrangements he had made for visiting the water-works. The vote of thanks having been passed with considerable enthusiasm, Mr. Severs, in thanking the members, said his works were perhaps not much larger than many a test plant with which some of them might be acquainted; but he had tried to do his best with the small plant he had. With regard to their visit, his family had tried to make it as pleasant as possible; and he always endeavoured to do his utmost to help any young man, if he only showed he had something about him to get on. He thought this was a spirit they all should cultivate.

It may be added that arrangements are now being made by the Council of the Association with Mr. Reynolds, the Director of the Manchester School of Technology, to form a special class for structural engineering as applied to gas-works construction. It is expected that this class will be included in the next syllabus, and commence in September, and that specially low terms will be fixed for the members of the Association.

Society of Arts.—The 149th annual meeting of the Society was held last Wednesday—Sir William Preece, the Chairman of the Council, presiding. The principal business was the reading by the Secretary (Sir Henry Trueman Wood) of the annual report of the Council, which recorded the work of the Society during last year. In all, 57 meetings were held for the reading and discussion of papers or the delivery of lectures. A number of prizes and medals were awarded; the Albert Medal, for eminent distinction in the promotion of the objects of the Society, having been given to Sir Charles Hartley, for his important engineering work in opening the navigation of the Danube.

The King's Birthday Honours.—Among the appointments His Majesty the King has been pleased to make on the occasion of the celebration of his birthday last Friday, we notice a peerage for Mr. G. T. J. Sotheron-Estcourt. The new peer is a land-owner in Gloucestershire, and represented North Wilts as a Conservative from 1874 to 1885. His elevation is mentioned here from his connection with a family one of whose members figured prominently in gas affairs in the Metropolis some forty years ago. Towards the close of the fifties, distracting proposals made by the Companies then supplying gas on the north side of the Thames led to prolonged inquiries in the House of Commons before Select Committees, one of which—that of 1860—was presided over by the Right Hon. T. Sotheron-Estcourt; and the Act of 1860 was the outcome. A representative of the other branch of the "JOURNAL's" work—that relating to water supply—was honoured; Major F. C. Rasch, M.P., one of the new baronets, being Chairman of the South-West Suburban Water Company.

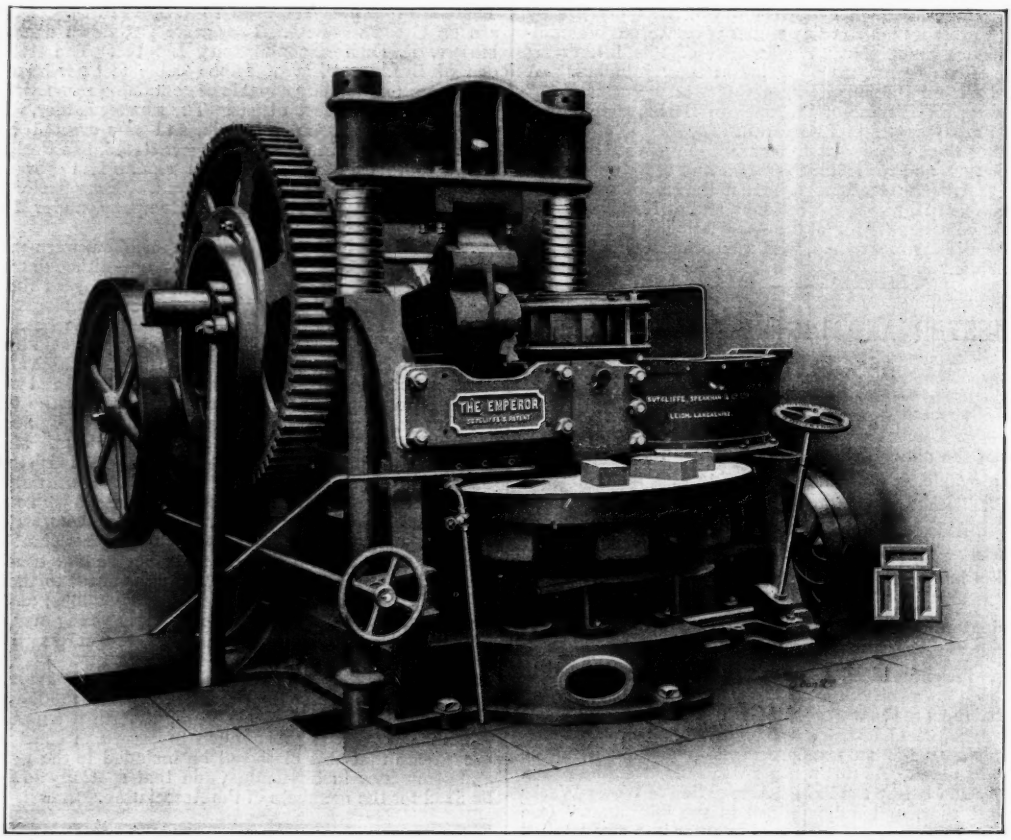
THE UTILIZATION OF GAS-WORKS CLINKER AND GAS LIME.

New works have just been put down at Leigh, near Manchester, by Messrs. Sutcliffe, Speakman and Co., Limited, for the construction of patented machinery and appliances for the utilization of gas-works clinker, and gas lime, and other waste products, in the manufacture of concrete building bricks and concrete paving flags by an entirely new process, for which exceptional advantages are claimed over existing methods.

Among several new machines is one named the "Emperor," of which we give an illustration, designed specially for dealing with gas-works clinker and gas lime, which is made exceptionally strong to withstand rough usage, and so arranged that renewals can be readily effected at comparatively small cost. This machine, of which the whole construction is the result of eight years' practical experience in this branch of brick making, is fitted with an automatic feeding pan to feed the moulds; the amount of feed being adjustable while the machine is in motion—thus enabling the density of pressure on the brick being varied at will without stopping the machine.

The bricks are not pushed from the moulds, but are delivered in four places; thus giving the attendant ample time to take away the bricks. The moulds are of Messrs. Sutcliffe and Speakman's special patented construction, and are lined with hard, high carbon steel, fixed in place without the use of screws. They are readily removed, and are so arranged that they may be turned round and also reversed and again turned round, thus presenting four wearing faces. The moulds and lines being made by special machinery accurately to template, they are interchangeable, and new sets of lines can be put into the moulds without fitting.

Experience has demonstrated that concrete and the above class of materials will not feed evenly into a mould, and, as all such materials are non-plastic, it results in bricks being made with the centre densely pressed, but with weak arrises and corners. The corners and arrises of such bricks readily crumble away. Messrs. Sutcliffe and Speakman have successfully overcome this serious objection by fitting the "Emperor" machine with their patent expression attachment. This operates by giving each brick two pressings. The first pressing squeezes and presses the material from the centre into the corners and arrises;



the final pressure finishing the brick. By these means, each brick is of even density throughout, with fine sharp corners and arrises.

In connection with this brick-making process, the materials, before being placed through the machine, are mixed in a patent steam heated mixer (also manufactured by the same firm). The kettle is constructed in such a manner that the materials are thoroughly heated and moistened by steam; an arrangement preventing the condensation of the steam on the sides of the kettle, and thus the dropping of condensed water on the material is avoided. An edge runner mill kneads and tempers the heated and moistened material, and thoroughly incorporates the mixture. For colliery shale brick manufacture, as well for the utilization of gas-works waste material, the machine is strongly recommended; as it regulates the moisture in the ground material (and every article acquires its proper amount of moistness), at the same time softening the shale. This results in less wear and tear of the machines, and considerably improves the quality of the bricks.

It is claimed that bricks made by the above process from clinker and lime and from clinker and gas lime are perfect in shape and form, have a higher crushing strength, and absorb less moisture than most of the ordinary clay bricks. The cost of manufacture, it is stated, is also much below that of ordinary clay bricks. Further, when made from gas lime and clinker, the principal cost is in labour, and in numerous instances the present expense of disposing of the clinker and gas lime would cover the entire cost of making the same into bricks.

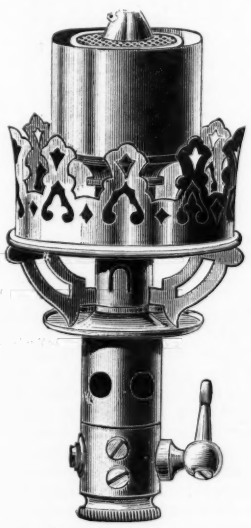
We have been shown samples of bricks made by the process which certainly bear out all the special advantages claimed for them. We may add that the firm are supplying plants complete in all details from 6000 bricks per day of 10 hours up to plants, of the largest capacity that may be required.

A SERVICEABLE AND READILY DISJOINTED INCANDESCENT BURNER.

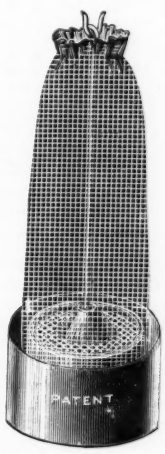
When discussing last July the question of the want of cheap yet respectable incandescent gas-burners, Mr. Charles Carpenter called attention to the fact that a third qualification was required, —viz., that the burner should afford ready facilities for cleaning, since, especially in dusty places, this is not the least important part of the duties which maintenance involves. The disadvantages of the present types of burners for rapid and easy cleaning consist of the fine thread with which the burner top is attached to the tube, and the fine thread by which the tube is connected with the nozzle piece. Mr. Carpenter experienced some difficulty in getting the burner makers to whom he submitted his ideas to realize these various points, and the result was that he designed a burner on his own account, and patented it. In addition to gaining his end in the way of securing a gas-burner with quickly

detachable parts for cleaning, he has combined in it a means of protecting the lower part of the mantle.

The burner is constructed of three separate parts, which simply slide into each other, to form the complete article. The gas-nozzle at the bottom, which also serves as the connection with the gas-fitting, is one piece; the tube up to the mixing-chamber at the head is the second piece; and the head itself is the third piece. The tube of the burner simply slides on to the gas-injector piece, and forms (assisted by three small clips round the tube) a perfectly firm joint with it. The burner head is also made so as to simply slide over the enlarged upper part of the tube. But this is not all. As will be noticed in the illustrations, the head is stamped out so as to give to it an outer casing which forms an annular space the full depth of the head. Now this has certain advantages. It protects the bottom of the mantle and prevents it swaying about; it assists (we find with a swinging "Surprise" pendant) in keeping the mantle central over the



THE BURNER, WITH BYE-PASS.



THE LIFT-OFF HEAD AND MANTLE PROTECTOR.

flame with a consequent gain in illuminating power; it prevents scraps of the frayed bottom portion of the mantle falling; and it serves as a good base for standing when the top is lifted off (with the mantle in position) for cleaning purposes. To those who have a large number of incandescent gas-burners under their care, none of these latter advantages, nor those of the sliding joints, need enlarging upon. The maintenance of incandescent burners has now become such a big business that anything that can be done to facilitate its performance must receive favourable consideration.

The first illustration shows the new type of burner with bye-pass; but it is made in several forms, and with or without the bye-pass as desired. In appearance it is similar to the ordinary "C" burner; the head only being a trifle larger. Besides its convenience attributes, the burner is a strong and serviceable one, and is likely to become very popular. The sole makers are Messrs. Falk, Stadelmann, and Co., of Farringdon Road.

THE CLAUS SULPHUR-RECOVERY PROCESS AT GRANTON.

A considerable portion of the section for Scotland of the last annual report of the Chief Inspector under the Alkali, &c., Works Regulation Acts (Mr. R. Forbes Carpenter), is devoted to the above subject. In view of the interest taken in Mr. Herring's fine works at Granton as the result of the publication of his description of them which has been appearing in our columns since the beginning of the year, we reproduce, practically in its entirety, this part of the report, a general notice of which appears elsewhere.

Mr. Carpenter begins by pointing out that the main object aimed at at Granton was not the recovery of sulphur, but the removal of the nuisance caused by sulphuretted hydrogen. Hence Mr. Herring desired the minimum of residual sulphuretted hydrogen to deal with, having provided ample limestone tower space for the removal of the sulphurous acid resulting from the reactions in the Claus kiln. Various points arose connected with the maintenance of heat in the jacket of waste boiler gases—this difficulty showing itself mostly when one still only was in operation. The week-end stoppage also tended to disorganize the correct working conditions as to temperature reached while the plant was in full operation. At a later date, the efficiency of the limestone tower in the removal of sulphurous acid became less. This was found due to the deposit of sulphur adhering closely as an amorphous impervious coating to the lumps of limestone, and not capable of being washed off by a flush of water. Mr. Carpenter deals further with this point later. He says it is certainly one of the difficulties arising in the special circumstances, and is not regarded as a material one in English practice, where a flush is found capable of removing the obstruction, consisting in this case of flowers of sulphur of crystalline form aggregated together.

During the summer stoppage of the plant, Mr. Herring, at Mr. Carpenter's request, sent him samples of the contact material in the kiln, taken from different depths, for examination at his laboratory. The filling consisted of oxide of iron in layers graduated as to size upwards from coarse to fine—finishing with a layer of 6 to 9 inches of washed Weldon Mud. When Mr. Carpenter was preparing his report, he thought there was no necessity to make any special remarks concerning this filling. It did not appear to have ever reached the temperature necessary for conversion into bisulphide of iron—the final product in Claus kilns connected with the recovery of sulphur from alkali waste—nor to have materially changed in chemical or physical condition. But while the report was passing through the press, an analysis of the top layer was completed; and it showed that chemical change had taken place, and to a considerable extent. This layer contained upwards of 30 per cent. of ferric sulphate, calculated as $Fe_2(SO_4)_3$.

In the following table are set out the analyses of the washed and dried Weldon Mud before going into the kiln, and of the sample drawn after about six months' use as "contact substance," with which the gases to be decomposed came first into contact. The material used in the experiments in Mr. Carpenter's laboratory was also analyzed for comparison; the results being set out in column A, and the Granton results in column B. In the latter, higher temperatures had been reached, and only traces of free sulphur were to be discovered. In the former, on the other hand, the material, though in loose granular condition, was found to contain 21·26 per cent. of sulphur extracted by solution in carbon bisulphide. Mr. Carpenter thinks this was probably the cause of the light brownish colour of the granular mass. In A, moreover, there is an indication of the first change in the contact substance from manganese oxide to manganous sulphate, which proceeded almost to completion in B, where, very possibly, at times, the temperatures exceeded those observed and recorded. Curiously, the appearance of the two samples, judged by colour only, is very similar; but the analyses show how little evidence can be obtained from this source.

—	A. Laboratory Kiln. Recorded Temperature Range = 360° to 500° F.		B. Granton Kiln. Recorded Temperature Range = 195° to 570° F.	
	Before.	After.	Before.	After.
CONSTITUENTS.				
(a) Soluble in Boiling Water.				
Moisture (loss at 105° C.)	..	..	..	1·75
Combined water (260° to 270° C. *in vacuo*)	..	..	..	5·00*
Manganous sulphate.	..	2·32	..	42·63
Calcium sulphate.	..	21·28	..	16·22
Magnesium sulphate.	..	0·30	..	0·90
Alkalies as sulphates.	..	3·95	..	5·45
Organic matter	..	..	..	Slight oily scum.
(b) Insoluble in Boiling Water.				
Organic matter (by combustion)	..	..	..	1·00
Manganese monoxide	2·67	21·69	4·35	3·89
,, dioxide	46·48	11·91	35·59	Absent
,, sulphide.	..	Absent	..	Absent
Calcium oxide	..	0·62	..	0·90
Alumina	Traces	Traces	0·46	0·90
Ferric oxide				5·71
Metallic iron (by magnet)	..	..	..	8·21
Sulphur (by carbon bisulphide)	..	21·26	..	Traces
Silica, &c.	0·73	0·81	0·78	6·55
	..	..	..	99·11

* 42·63 $MnSO_4$ requires 5·08 H_2O by theory to convert into $MnSO_4\ H_2O$ (47·71).

In both samples analyzed, it was impossible to distinguish manganese sulphide. Clearly the intermediate stage between manganese oxide and manganous sulphate is very quickly passed. Mr. Carpenter points to the interesting fact that the latter is in the hydrated form, the compound holding its water tenaciously at temperatures exceeding those reached in the reactions. The presence of metallic iron in the Granton sample after use was, at first, a puzzle. The form of the particles, however, extracted by the magnet suggested the solution that they had been introduced

Reaction of Dilute Sulphuretted Hydrogen with Manganous Sulphate.

Controlling Factors.	Contact Substance.									Gases Leaving Tube.				Efficiency.		
	Temperature—° F.			Reacting Mixture.				Air Required by Theory for Reaction.		Sulphur Grains per Cubic Foot.				H_2S Per Cent. of Total Entering.		
	Glycerine Bath. (*a*)	Contact Substance at Inlet. (*b*)	Difference. (*b*—*a*)	Rate of Flow. Cub. Ft. per Sq. Ft. per Min.	100 Volumes contain H_2S. (*c*)	CO_2. (*d*)	Air. (*e*)	$H_2S + O = H_2O + S = 2{\cdot}5\ H_2S$. $2{\cdot}5 \times (c)$.	$H_2S + O_3 = H_2O + SO_2 = 7{\cdot}5\ H_2S$. $7{\cdot}5 \times (c)$.	As H_2S.	As SO_2.	As Free S., &c. (by diff.)	Total.	Escapes. As H_2S.	Oxidized. To SO_2.	Oxidized. To Free S., &c.
A.—Temperature																
1. Air = 6·10 H_2S	401	410	..	1·01	5·0	64·5	30·5	12·5	37·5	5·4	13·9	12·2	31·5	17·1	44·1	38·8
2. Air = 6·12 H_2S	322	320	..	0·97	4·9	65·1	30·0	12·3	36·9	13·5	5·1	12·2	30·8	43 8	16·6	39·6
B.—Air Supply																
3. Air = 2·58 H_2S	390	407	17	1·86	12·2	56·3	31·5	30.5	91·5	25·4	0·9	49·9	76·2	33·3	1·2	65·5
4. Air = 3·23 H_2S	396	407	11	1·39	11·0	53·5	35·5	27·5	82·5	23·3	3·1	42·1	68·5	34·0	4·5	61·5
5. Air = 3·64 H_2S	394	408	14	1·17	7·7	64·3	28·0	19·2	57·6	9·8	4·9	33·0	47·7	20·5	10·2	69·3
6. Air = 6·10 H_2S	400	412	..	1·36	5·0	64·5	30·5	12·5	37·5	6·4	11 1	14·0	31·5	20·3	35·2	44·5
C.—Rate of Flow																
7. Air = 3·68 H_2S	393	404	11	0·72	7·6	64·4	28.0	19·0	57·0	6·4	5·3	35·5	47·2	13·6	11·2	75·2
8. Air = 3·64 H_2S	395	411	16	1·63	7·7	64·3	28·0	19·2	57·6	13·1	4·4	30·7	48·2	27 2	9·1	63·7
9. Air = 6·10 H_2S	403	410	..	0·65	5·0	64·5	30·5	12·5	37·5	4·5	16·7	10·3	31·5	14·3	53·0	32 7
10. Air = 6·10 H_2S	400	412	..	1·36	5.0	64·5	30·5	12·5	37·5	6·4	11·1	14·0	31·5	20·3	35·2	44·5
Granton Kiln—	Furnace Gases.															
Air = 7·24 H_2S	395	280 (pt. A) 570 (pt. B)	..	0·54	5·2	57·1	37·7	13·0	39·0	7·2	5·6	19·8	32·6	22·1	17·2	60·7

NOTES.—Each set of results, 1, 2, &c., is the mean of several experiments. In the above calculations no correction is made for contraction of volume due to reaction.

accidentally. This was confirmed by the analysis of the material before use in the kiln; for Weldon Mud, by its very preparation, should contain only minute percentages of this oxide. The probabilities point to the use of iron borings for making rust-joints of pipes about the top of the kiln, and the spilling of a tray of them just at the point where the sample had been taken near the manhole.

It naturally became a point of interest to determine the conditions of activity as "contact substance" of the manganous sulphate in sample B. On this occasion, it seemed desirable, for various reasons, to modify the laboratory trial apparatus, which had to be on a smaller scale than in the experiments recorded in a previous report. Having described the apparatus employed, and the methods of analysis, Mr. Carpenter gives the results in the accompanying table, which he drew up on lines very similar to those followed in presenting the results of experiments made at the works in 1901.* From those given in the table, the following conclusions are drawn respecting the working conditions most favourable for the maximum decomposition of sulphuretted hydrogen, accompanied by the highest yield of sulphur in the free state, apart from other considerations.

1. *Working Temperature of the Contact Substance.*—This should not fall below 400° Fahr. Compare Experiment 2 (320° Fahr.), 39·6 per cent. as free sulphur, and 43·8 per cent. of sulphuretted hydrogen escaping unoxidized, with Experiment 1 (410° Fahr.), 38·8 per cent. as free sulphur, and 17·1 per cent. of sulphuretted hydrogen escaping unoxidized. A higher temperature results in oxidation of the sulphur formed to sulphurous acid, especially if excess of air be present. Compare Experiment 9 (air 6·10), 53 per cent. of sulphuretted hydrogen oxidized to sulphurous acid, with Experiment 10 (air 6·10), 35·2 per cent. so oxidized.

2. *Air Supply.*—The proportion of air present in the reacting mixture should not exceed 3½ to 4 times that of the sulphuretted hydrogen present (2½ times being the theoretical minimum for complete decomposition to sulphur and water, 7½ times for complete oxidation to sulphurous acid and water). Compare Experiment 7 (air 3·68, sulphuretted hydrogen 1), 75·2 per cent. as free sulphur, and 13·6 per cent. of sulphuretted hydrogen escaping unoxidized, with Experiment 9 (air 6·10, sulphuretted hydrogen 1), 32·7 per cent. as free sulphur, and 14·3 per cent. of sulphuretted hydrogen escaping unoxidized.

3. *Rate of Flow of Reacting Mixture.*—This should not much exceed 0·75 cubic foot per minute per square foot superficial. Compare Experiment 7 (rate 0·72 cubic foot), 75·2 per cent. as free sulphur, and 13·6 per cent. of sulphuretted hydrogen escaping unoxidized, with Experiment 5 (rate 1·17 cubic feet), 69·3 per cent. as free sulphur, and 20·5 per cent. of sulphuretted hydrogen escaping unoxidized, and with Experiment 8 (rate 1·68 cubic feet), 63·7 per cent. as free sulphur, and 27·2 per cent. of sulphuretted hydrogen escaping unoxidized.

Mr. Carpenter is careful to point out that there are practical considerations which have to be weighed in drawing conclusions as to the best conditions for working such a process. During the progress of the experiments he is dealing with, it was found that towards the close of the last series, from which the results were tabulated, the limb of the U-tube where the gases left the contact substance became clogged with free sulphur to such an extent as to necessitate constantly increasing pressures in the gas-reservoir to force the gases through at the desired speeds. Moreover, in the working of the Granton kiln itself, it has been found that the sulphur which escapes to the "flowers" chamber as the result of this (comparatively) low-temperature reaction does not aggregate, drop, and settle in the first bays of the chamber to any material extent, but passes on, in a very fine state of division, to the limestone tower—the succeeding element in the apparatus. As already mentioned, its power of adherence to the limestone interferes with the efficiency of the tower in removing sulphurous acid; and not only so, but an obstruction to draught is caused, so that from time to time it has been found necessary to empty and refill the tower. This peculiarity, which does not obtain in plants where gases stronger in sulphuretted hydrogen are treated, is attributed, and with some probability (though Mr. Carpenter thinks it would be rash to dogmatize), to the combined effects of low temperature in the kiln and low percentage of sulphur in the reacting gases.

During the progress of the experiments, which extended over a considerable period, but were subject to much interruption by other more pressing work, the question presented itself of determining what was the theoretical amount of heat evolved in the reaction—what, in fact, was the maximum temperature, apart from all losses by radiation, or of heat carried away by conduction through the walls of the apparatus, that would be evolved in treating a gaseous mixture containing a given percentage of sulphuretted hydrogen. Mr. Linder (Mr. Carpenter's assistant) kindly undertook this inquiry—one which demanded much collation of authorities for the physical data, and considerable patience and skill in applying the data when obtained to reach the solution of the problem set out above. The results are given in a table which was included in the paper prepared by him, in association with his chief, for the Society of Chemical Industry, and read at a meeting of the Liverpool Section early in the present year. It was entitled "Studies on the Claus Kiln Reaction;" and the first portion, in which the authors dealt with the heat reactions of different gaseous mixtures, contained the table above referred to. As it has been so recently given in the "JOURNAL" (*ante*, p. 368) it is unnecessary to repeat it.

Mr. Carpenter appends two examples from Mr. Linder's calculations; and to these, as well as to the whole of this section of the report, we must refer those of our readers who are specially interested in the subject.

*See "JOURNAL," Vol. LXXX., p. 498.

At a recent meeting of the Royal Meteorological Society, Mr. C. P. Hooker read a paper on the relation of the rainfall to the depth of water in a well. He gave the weekly measurements of the depth of water in a well (101 feet deep) and the amount of rainfall at Cirencester, extending over the sixteen years 1887-1902. The depth of water in the well depends on how much rain penetrates, and the penetration is determined by the amount of rain, the rapidity of its fall, and the existing condition of the soil. The winter rains penetrate easily, and the summer rains with difficulty. Mere absence of rain is not the only cause of scarcity; deficiency of spring rains, and subsequent heat and evaporation, being far more important factors. Considering how narrow is the boundary between sufficiency and want, and looking to the fact that every year sees further demands made on our water supplies, the author considers that it is of the utmost importance that more attention should be paid to the storage of the surplus winter rains. This might, he thinks, be done by the formation of large hill reservoirs; and doubtless such measures as the reafforesting of large tracts of land would be of use in checking the rapidity with which the rains reach the rivers and are lost.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

The Fiscal Problem and the Coke Trade.

SIR,—I have read with interest the article on the above subject in your issue of the 23rd inst., and I think you are mistaken in endeavouring to show that it is possible that an import duty on corn would not be paid by the consumer through a comparison with the gas coke trade with the Continent, as corn and gas coke are produced under quite dissimilar conditions. Corn will only be sold to this country at a price which pays the producer; while gas coke is manufactured without consideration of demand, and must be disposed of, whether the price pays or not.

T. HARDIE.

Redheugh Gas-Works, June 27, 1903.

[We are glad that our attempt to throw light upon the difficult and doubtful problem of the incidence of some fiscal imposts has elicited comment. It is repeated in our "Editorial Notes" in the present issue; and we trust that the further explanation now given will equally interest Mr. Hardie. Meanwhile, we cannot see that the distinction he draws is material.—ED. J.G.L.]

REGISTER OF PATENTS.

Gas-Engines.—Rowbotham, W. & K. A., of Edgbaston, Birmingham. No. 7104; March 24, 1902.

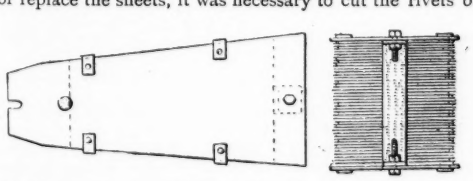
The patentees claim as their invention in relation to gas-engines: (1) The use in conjunction with the working cylinder of an air compressing pump to provide air for use in the working cylinder; such pump being operated from the piston of the working cylinder at all times, but particularly so that at such time as the working cylinder is insufficient in power (too much work being suddenly put on the engine) the efforts of the cylinder are absorbed in the pump to increase the pressure of the air used in the working cylinder as part of the motive power. (2) The use in such an engine of differential gear between the motor or work-shaft and the air-compressing pump. (3) A method of scavenging the cylinder, of enabling a high compression pressure to be used, and of increasing the expansion—that is to say, providing the working cylinder so that its piston will draw in air for its full outer stroke, force a part of the drawn-in air out of the cylinder through the scavenging port for a portion of its inner return stroke, and then compress the air remaining in the cylinder to a high pressure in the completion of the return stroke, during, or after, which the cylinder receives a forced-in charge of rich gases "sufficient to heat the compressed air to expand it or to make a highly efficient explosive mixture to be ignited in the cylinder."

Self-Igniter for Gas-Burners.—Parizot, F. C. N., of Bremen, Germany. No. 12,152; May 28, 1902.

This invention relates more particularly to the class of self-igniters in which the igniting mass is brought and held out of the flow of the hot gases after having ignited the gas. The essential feature of the arrangement consists of a small ventilator-wheel (preferably made of mica) which, mounted above the chimney of the burner and being rotated by the upward current of hot products of combustion, carries the igniters hanging down therefrom out of the flow of the hot gases, and so prevents injury to them.

Gas Washing and Scrubbing Revolving Surfaces.—Kirkham, H., and Chandler, S. A. No. 13,334; June 12, 1902.

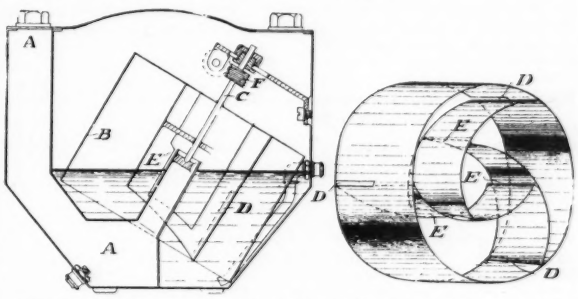
This invention refers to patent No. 2085 of 1881, for indenting iron sheets in order to form spaces between them through which the gas passes. A number of these were riveted together to form bundles by rivets passing through them; but it was found in practice that, in order to clean or replace the sheets, it was necessary to cut the rivets out, and



by so doing numbers were destroyed. The present improvement obviates this, as it is not proposed to employ rivets, but to place the thin sheet iron or steel into a receptacle after indentation in order to maintain the spaces for the passage of the gas, and secure them in the receptacle by straps covering the top of the sheets and attached to the sides of the receptacle. [See illustration.]

Wet Gas-Meters.—Alexander, W., of Edinburgh. No. 16,153; July 21, 1902.

The patentee describes a meter consisting of a cylinder or drum divided into three or more compartments, the axis of which is fixed nearly vertical but inclined to one side, so that as the drum revolves in the water one side is considerably more submerged than the other. The drum is open at the bottom; and the gas is let into each compartment in turn. The outlet of the compartment will be under the surface of the water until the inlet has, with the rotation of the drum, also gone under the surface of the water. Thus in turn each compartment has its inlet opened to the supply connection, and then also in turn its outlet opened to the exit connection. The revolution about the axis is caused by the pressure of gas upon the side of the partition of the compartment being filled being greater than the pressure on the other side—the compartment being emptied. The level of the water in the case around the drum (to seal same) is kept constant by a spoon or other device to raise water from an outer or inner chamber; the spoon being attached to the drum and by its varying height lifting and delivering the water as required.

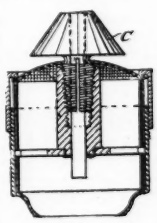


There is shown a cross section of the entire meter, and a plan of the drum only, with the cover or top removed.

A is the outlet for the gas; B, the cylinder or drum; C, the axis; D, the outlets; and E, the inlets. By varying the angle at which the axis of the drum is fixed, a greater or less quantity of gas will pass through the cylinder at each revolution, as the quantity contained in each compartment when highest out of the water will be greater or less, as compared to that contained in the same when lowest in the water, according as the angle of the axis C with the horizontal is made smaller or larger. F is the gearing indicating the number of revolutions of the drum.

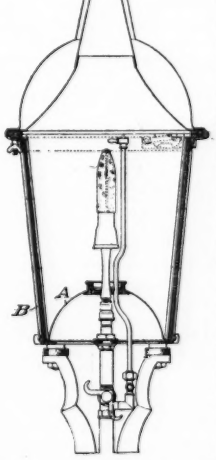
Incandescent Gas-Burners.—Wise, W. L.; a communication from Bruno, Schömann, and Co., of Berlin. No. 16,096; July 19, 1902.

This invention has for its object to enable incandescence mantles to be arranged at any desired height above the burners.



Within the head of the burner, it is proposed to centrally arrange a socket (as shown), the aperture of which is tapered downwardly, and is provided with an internal screw-thread that engages an external thread formed upon a split plug made in one piece with a cone C. The rod support for the mantle is passed through, and is guided by, the cone and plug. The plug is split into several segments; and the support is so tightly fitted in the guide that, when inserted, it forces the segments apart. If the plug be now inserted into the socket, the segments of the plug will be again pressed together, and thereby hold the mantle-rod in position. If the mantle burns away, or the rod breaks off below, it is sufficient merely to take the cone and plug out of the burner and again adjust the rod, and secure it in the new position in the head of the burner.

Gas-Lamps.—Webb, J. E., of Poultry, E.C. No. 16,291; July 22, 1902.



The patentee proposes to obtain an "intensified" light in a gas street-lamp fitted with an incandescent burner, by "employing a closed lamp and allowing the air to support combustion to be supplied to the flame only at the combustion point after it has been mixed with the gas at the atmospheric part of the burner; the partial vacuum obtained inside the lamp caused by the superheating of the air by the combustion at the mantle causing the compression of the air and gas and intensification of the light."

The hood of the lamp (as shown) is formed with light-reflecting surfaces, and makes an air-tight joint with the body. Around the burner is arranged an inverted reflecting surface A, provided with a collar enclosing rubber or like packing surrounding the burner-pipe and the bye-pass. The bottom of the reflector is formed of wire gauze or other open material, which, while admitting air to the lower openings in the burner-pipe, prevents sudden draughts of air. Metal double channel or angle pieces B, secured to the top and base frames, are so formed as to fit the glass and make air-tight joints therewith; and the latter is bedded in asbestos or similar packing at the top and bottom, so as to allow for expansion.

Gas or Air Compressors or Pumps.—Keith, J. & G., of Farringdon Avenue, E.C. No. 16,436; July 24, 1902.

This invention relates to compressors or pumps of the kind referred to in patent No. 13,926 of 1900; and it has for its objects to make provision for entirely encasing the apparatus to satisfy the requirements of insurance regulations, while overcoming or reducing liability to

fluctuation in the gas supply-pipe, and compensating for any pulsation caused by the intermittent action of the pump.

The apparatus consists of an outer enclosing cylinder or casing and an inner open cylinder fixed to a base; the cylinders being preferably set eccentrically to accommodate the usual delivery standpipe. Over the inner cylinder is loosely fitted a pumping-bell enclosed by a second bell furnished with a ring weight, and which acts as the regulating holder. The pumping-bell is reciprocated by a water-motor fitted vertically on the base; the arrangement (as also the construction of the motor) being similar to that described in the 1900 patent. But the main and auxiliary valves which control the action of the motor-piston are fixed under the base in one casing, which is held up to the base by the cylinder to whose lower end it is secured by screwing or otherwise, so that it can be readily detached.

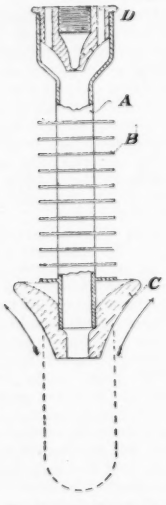
Bye-Pass Cock for Incandescent Gas-Burners.—Keith, J. & G., of Farringdon Avenue, E.C. No. 16,773; July 29, 1902.

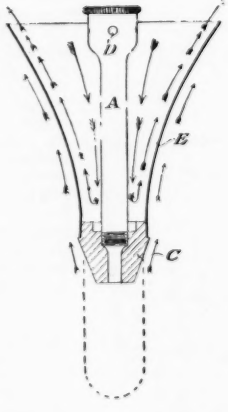
This gas-cock with a flashing bye-pass is designed to increase the size of the usual pilot-jet at the moment of turning on the main supply to the burner, so as to ensure lighting the burner when the bye-pass is fitted in the ordinary way close to the incandescent mantle, and also for lighting a burner from outside the globe or mantle protector when the bye-pass tube is at some distance from the burner. The cock is of the usual plug type; but its body is formed with a number of parallel ports (preferably three) in different positions in relation to the plug, which has, in addition to the usual through-way, a groove or slot cut in its side, to which groove, in one position of the plug, all the ports are open—that position being the one in which the gas is being turned on and the through-way partly open. All the ports open to one common passage which leads to the bye-pass. One of the ports forms a permanent bye-pass, which is clear of, and is not affected by, the working of the plug. The second port forms the main supply for the pilot-light, and is opened when the main supply to the burner through the plug is cut off, and is shut entirely when the gas is open to the burner or burners. The third port is opened when the cock is midway between the open and closed positions—*i.e.*, when the main gas supply to the burner is partially opened—and is shut off when the cock is in the full-on position.

Inverted Incandescent Gas-Burners.—Hellman, H. W., of Berlin, No. 22,704; Oct. 18, 1902.

From bunsen burners for downwardly burning incandescent gas-lamps as heretofore constructed, this invention is distinguished by employing a mixing or burning tube made of a good conductor of heat, with means for effectually cooling same by air or by preventing the excessive heating of the mixing and burner tube, and thereby obviating the rapid destruction of these parts and the burning-back of the flame into the burner-tube by means of a burner tip or nozzle of fire-proof or refractory material at the lower end of the good conductor of heat, of a diameter larger than the mixing and burner tube. This construction is said to present the advantage that the hot gases which ascend from the downwardly extending burner flame are laterally deflected from the entire length of the mixing-tube, so that the heat does not ascend vertically in the direction of the mixing-tube, and the overheating of the latter is obviated.

The first illustration shows a bunsen burner where the mixing-tube A (of metal) is surrounded with metal discs B, which increase the radiating surface of the tube, so that the air surrounding it is capable of producing increased cooling action. To the lower end of the mixing-tube a fire-resisting nozzle or burner-tip C is secured, made of heat non-conducting material—such as soap stone, magnesia, porcelain, or the like. The burner-head is of larger diameter than the mixing-tube with its radiating surfaces; and it is conically tapering upwards, or





enlarged towards its upper end, so that the gases which are heated by the downwardly directed burner flame are laterally deflected. The incandescent mantle is interchangeably suspended from the burner-tip in various ways not entering into this invention. Air is admitted to the interior of the mixing-tube by openings D arranged in a circle around the gas inlet in the upper part of the mixing-tube, and axially placed in the nozzle part. Inasmuch as the hot gases of combustion are already deflected rather out of the way at the burner head, the air admitted into the upper part of the mixing-tube through the air admission openings is heated only to a small extent or not at all; and it thus arrives in comparatively cool condition into the interior of the mixing-tube.

In the second arrangement, a tube E, enlarged in its upper part, is secured to the heat non-conducting refractory burner-tip C of the metal mixing-tube. By this means, the mixing-tube is surrounded by a heat isolating layer of air which is contained between the walls of the mixing-tube A and the tube E. The waste gases rising up from the mouth of the burner flow along the outside of this mantle, so that the mixing-tube itself is protected against the direct action of the gases. The heating of the tube E which is produced by the hot gases results also in the constant renewal of the layer of air contained in the interior, because the air is submitted to a greater heat in the lower than in the upper part, which is at a considerable distance from the burner flame. Thus the metal mixing-tube is kept cool not only by an insulating, but also by a circulating, layer of air, or it is cooled in this manner.

APPLICATIONS FOR LETTERS PATENT.

13,342.—Liddle, E., and Druiff, G. E., "Gas-burners." June 15.

13,343.—Johnston, A. A., "Conveying coke from retort-benches, and quenching same." June 15.

13,345.—Severin, H., "Gas blowing machine." June 15.

13,412.—Grossmann's Cyanide Patents Syndicate, Ltd., and Grossmann, J., "Manufacture of cyanides." June 16.

13,466.—Töhl, A., "Freeing of gases from carbon disulphide." June 16.

13,476.—Dowson, J. E., "Gas-generators." June 16.

13,500-1.—Crossley, W. J., and Atkinson, J., "Internal combustion motors." June 17.

13,525.—Haigh, S., "Automatically cutting off the gas supply to a burner, the flame of which has been extinguished." June 17.

13,540.—Woods, J. E. T., and Hamond, J. B., "Incandescent mantles." June 17.

13,541.—Sugg, W. T., "Mantle-supports for incandescent gas lighting." June 17.

13,555.—Fishley, A. H., and Grieve, J., "Automatically controlling the consumption of gas in railway carriages." June 17.

13,633.—Casse, A., and Diguef, H., "Producing astereo gas for lighting, heating, and power purposes." June 18.

13,648.—Horn, G., "Gas-retorts." June 18.

13,661.—Smethurst, W., "Production of combustible gas." June 18.

13,677.—Berthold, C. E. J., "Automatic gas-lighters." June 18.

13,684.—Wright, J. W. B., and Darwin, H., "Laundry irons for use with gas." June 19.

13,685.—Hall, A., "An improvement on, or addition to, existing patent No. 5769 (Gas-burner)." June 19.

13,748.—Abel, C. D., "Producing heating gases free from hydrocarbons from gas-containing fuel in gas-producers." A communication from Gasmotoren Fabrik Deutz. June 19.

13,757.—Rowbotham, W., "Gas and like engines." June 20.

13,763-4.—Crossley, W. J., and Rigby, T., "Gas-producers." June 20.

13,773.—Price, W. A., and Baker, F. R., "Coin-boxes of gas-meters." June 20.

13,801.—Boult, A. J., "Portable gas-burning heating apparatus." A communication from W. A. Köneman. June 20.

PARLIAMENTARY INTELLIGENCE.

GLEANINGS FROM THE COMMITTEE ROOM.

Committee work has been drifting placidly along since last there was anything to note; but the lists have been absolutely devoid of interest in gas and water. Those Bills, however, that have to face the ordeal of an investigation in the second House are now stepping forward. Their number will be few; and of that few some are expected to come on early this week. The Crystal Palace District, the Walker and Wallsend, and the Hexham Gas Companies' Bills are among those already referred; and the same opponents who met them in the first House are again in the field. The Local Authorities in the Crystal Palace Gas Company's district are immensely concerned over the easy victory that the Company had when before Sir John Brunner's Committee; and they hope for better luck in their attempt in the Lords to upset 13-candle power gas and the proposed remission of the sulphur clauses. In the case of the Walker and Wallsend Gas Company's Bill, the Newcastle Corporation will again challenge them on the land clauses. At the end of last week, the Brighton Gas Company were among the opponents to the Brighton Tramways Bill; adequate protection for their mains being the object of their presence. The water clauses of the Sheffield Corporation Bill have gone through the Commons Committee; and various Provisional Orders by the Board of Trade or the Local Government Board—among them the Aldershot Gas and Water Order and the Portadown and Banbridge Water Order—have been investigated by Committees, and allowed to proceed. The Bury and District Joint Water Board Bill is in a group now being considered by a Lords Committee.

Sheffield Corporation Bill. There was a large gathering of the City dignitaries, officials, and legal representatives of Sheffield in Committee Room No. 8 last Tuesday when Mr. Heywood Johnstone's Committee were invited to turn their attention to the Omnibus Bill promoted by the Corporation. Looking cursorily at its scope, this measure seems to touch nearly every department of municipal work; and in one or two respects it has interest for "Journal" readers. In one section, the Corporation asked permission to deal in electric motors and fittings; and the electrical traders of the city opposed it. However, quite at the

eleventh hour, the Corporation gave way to a sufficient extent to conciliate the aggrieved ones. It was agreed, among other things, that the Corporation should only purchase, supply, sell and let for hire, but not manufacture, goods of this kind. This was an easy way of settling the matter. The Corporation have also, without opposition, got clauses through which protect them—by giving them power to charge a minimum annual sum—in the matter of stand-by electricity supplies. The clauses are worth reproducing as an example for the future.

Notwithstanding anything contained in the Electric Lighting Acts, 1882 and 1888, a person shall not be entitled to demand from the Corporation a supply of electrical energy to premises having a separate supply (that is to say, a supply from an installation other than that of the Corporation) unless such person shall have previously agreed to pay to the Corporation such minimum annual sum as will give to the Corporation a reasonable return on the capital expenditure and other standing charges incurred by the Corporation to meet the possible maximum demand of such person.

In case the Corporation and the person demanding such supply of electrical energy shall fail to agree on the amount of the minimum annual sum to be paid by such person, the amount of such minimum annual sum shall be fixed by an electrical engineer to be appointed as arbitrator by the President of the Institution of Civil Engineers.

In the water section of the Bill, permission is sought to divert the proposed tunnel between the Derwent reservoir to the Rivelin lower reservoir—the diversion being not only an improvement, but it will have the effect of shortening the conduit by some 550 yards. There will also be a total approximate saving in expenditure of £30,000 to the Corporation and the Water Board; and a further advantage is that the water will be delivered in Sheffield at such an elevation that it can be supplied to parts of the district above those which could be supplied under the original proposal. Mr. Alderman Gainsford, Mr. L. S. Marsh, and Mr. William Terrey were the witnesses on this section. From Mr. Terrey's explanation of the financial proposals, it appears that the Corporation originally obtained power to borrow £800,000 for the water undertaking; and they now seek to borrow £489,108 more. Of the £800,000 originally sanctioned, £576,464 was expended up to September last. Of the new borrowing powers, £331,130 will be required for completing the Little Don Valley works, and £157,978 for the extension of mains and other purposes in connection with the existing works. There was no opposition; and the sections of the Bills referred to here were passed by the Committee.

Portadown and Banbridge Join Hands. Very wisely, Portadown and Banbridge some time since determined to jointly approach Parliament, through the Local Government Board for Ireland, with a water scheme; and the Provisional Order which the latter have since made was included in a Confirmation Bill which was discussed before Mr. George Whiteley's Committee last week, and over this one scheme at three different sittings. There is no doubt about it that the water supply of the district is in bad case; the principal sources being wells which are liable to sewage contamination. The scheme which the Joint Authorities propose is the taking of water from the River Shimna (which runs from the Mourne Mountains), with powers over a drainage area of 943 acres. The water would be carried from Shimna by pipe-lines to service reservoirs outside the two towns; the scheme being from beginning to end a gravitation one. The estimated cost of the work complete is £58,000. Lord Annesley opposed, on the ground that he feared the scheme would affect certain small mills belonging to him, and Lord Roden, because he believed it would affect his estate. The scheme only contemplates the taking of 630,000 gallons a day. The capacity of the proposed reservoir, according to Mr. J. H. Sweeney, the Engineer, is 75 million gallons. The Bill was allowed to proceed, with a clause inserted making provision for a supply, if necessary, for domestic purposes, to Newcastle (Co. Down) on agreed terms or as determined by an arbitrator. It is believed that next Thursday, an effort is going to be made in the House to reject this Order.

HOUSE OF LORDS.

The following further progress has been made with Bills:—

Bills reported: Bradford Corporation Bill, Gas and Water Orders Confirmation Bill, Gorleston and Southtown Gas Bill, Hampton Court Gas Bill, Local Government Provisional Orders (Gas) Bill, New Hunstanton Improvement Bill.

Bills read the third time and passed: Bournemouth Gas and Water Bill, Commercial Gas Bill, Gas and Water Orders Confirmation Bill, Gaslight and Coke Company Bill, Gorleston and Southtown Gas Bill, Grangemouth Water Order Confirmation Bill, Ipswich Gas Bill, Local Government Provisional Orders (Gas) Bill, New Hunstanton Improvement Bill.

The Crystal Palace District Gas Bill and the Leigh Corporation Bill have been referred to a Select Committee, consisting of Lord Herries (Chairman), Lord Kilmaine, Lord Braye, Lord Strathspey, and Lord St. Oswald; to meet to-day.

HOUSE OF COMMONS.

The following further progress has been made with Bills:—

Bills brought from the Lords, read the first time, and referred to the Examiners: Bournemouth Gas and Water Bill.

Bills reported: British Gaslight Company (Norwich) Bill [Lords], Sheffield Corporation Bill, Torquay Corporation Water Bill [Lords].

Lords Bills read the third time and passed: Belfast Water Bill, Harrogate Water Bill, Harrow and Stanmore Gas Bill, Rickmansworth Gas Bill, Shepshed Urban District Gas Bill.

The Barnsley Corporation (Water) Bill has been withdrawn.

Last Wednesday, a return was ordered, on the motion of Mr. Ellis (Rushcliffe), showing the total indebtedness of the Borough Councils, other than Metropolitan Boroughs, in England and Wales, on the 31st of March last

SHEFFIELD AND THE DERWENT WATER SCHEME.

Last Tuesday, the Police and Sanitary Committee, presided over by Mr. Heywood Johnstone, had before them the Bill of the Sheffield Corporation, in which (*inter alia*) further powers are sought with regard to the water undertaking. The principal object, as explained by Mr. Claude Baggallay, was to enable the Corporation to have a new aqueduct or line of pipes through a substituted tunnel, for the purpose of bringing to Sheffield their share of the water to which they were entitled under the Derwent Valley water scheme sanctioned by Parliament in 1899. Under the Act passed in that year, a Water Board was constituted, who were authorized to carry out a number of works on the River Derwent; and a certain proportion of the water was allocated to Sheffield, to obtain which it was necessary to construct a tunnel through some high land. In 1901, a second Act was passed, by section 5 of which the Board were allowed to abandon the Derwent reservoir authorized in 1899, and make another at a considerably higher level. It was now desired to raise the level of the tunnel by which the water was to be conveyed from the works in the Derwent Valley into the limits of supply of Sheffield, and also to vary the arrangements by which the water was to be conveyed into the Derwent Valley itself. By the present Bill, the tunnel would be shortened by about 550 yards, which would save a considerable sum to the Corporation, and also enable the water to be taken in the Derwent Valley in such a way as to be economical to the Water Board. Another advantage would be that by the new tunnel the water would be delivered in the Sheffield area at such an elevation that it could be supplied to all parts of the district. In order to avoid opposition, the line of the tunnel had also been somewhat varied. To enable the changes to be carried out, an agreement had been entered into between the Corporation and the Water Board. Another variation would be that, whereas by the Derwent Valley Water Act of 1899, the Board were required to filter or treat all water which was to be supplied by them, under the new provisions Sheffield would itself deal with it. Mr. W. Terrey, the General Manager of the Sheffield water undertaking, said the works proposed were in reality the same as those authorized by the Act of 1899; and it was therefore necessary that the borrowing powers should be continued. In 1896, borrowing powers were obtained to the extent of £720,000 for waterworks; and of this sum up to September last £576,464 had been expended. A further amount of £365,199 would be required. The Committee passed the water portion of the Bill.

SUPPLY OF WATER TO ALDERSHOT CAMPS.

A Committee of the House of Lords, presided over by the Earl of Belmore, were on Tuesday asked by the Aldershot Gas and Water Company to confirm a Provisional Order made by the Board of Trade. Mr. Hutchinson, for the promoters, said the Order was to enable the Company to raise additional capital for their existing undertaking, and to devote to the purposes of manufacture certain additional lands. They also wanted to supply the camps outside the urban district of Aldershot. This, however, they could not do from their present levels; and so they proposed to sell water in bulk to the Frimley Water Company, who would supply the camps. The capital proposed to be raised was £100,000 by shares and £33,000 on loan—£40,000 to be devoted to water. The opposition from the Aldershot Urban District Council and the Frimley Company was principally on clauses, and was, in reality, an opposition of one opponent to the other. Mr. Talbot asked that a clause should be inserted on behalf of the Council, whose view was that, looking at the rapid growth of the district, it was essential that an outside supply should be brought under very strict regulations and control. Mr. Acworth, on behalf of the Frimley Company, objected to the insertion of the proposed clause, one provision of which set forth that the Company should pay the Aldershot Company 2s. 6d. per 1000 gallons for any water other than that supplied to them for the use of the camps. A witness from the War Office supported this objection; contending that, when their ten years' agreement with the Frimley Company came to an end, if the Company were charged 2s. 6d. per 1000 gallons for domestic supply, they would probably recoup themselves by fixing the price to the camps at a higher figure. The Committee decided that the Order might proceed without the insertion of any clause on the point raised.

LEGAL INTELLIGENCE.

COURT OF SESSION.—Tuesday, June 23.

(*Before Lord* Low.)

The New Conveyor Company and their Patent.

In the Court of Session to-day, the action brought by the New Conveyor Company, Limited, against the Edinburgh and Leith Corporations Gas Commissioners, to recover £2500 as damages, and for interdict against infringement of the letters patent No. 20,709, dated Nov. 16, 1892, granted to Ludovic Van Vestrant and Maurice Graham, then of 86, Leadenhall Street, London, for "Improvements in Charging Inclined Gas-Retorts," was mentioned. The record was closed on the 17th of March last, and proof ordered on a day to be afterwards fixed; but the parties have never yet adjusted their pleadings.

Mr. CRAIGIE appeared for the pursuers; Mr. J. DUNCAN MILLAR represented the defenders.

Mr. CRAIGIE moved that the case be sisted, for the reason that it had been found that the complete specification of the patent did not correspond with the provisional specification; too much being claimed in the former. Under the seventh head, the pursuers claimed a piece of iron inserted into the mouth of the retort "specified as herein described."

They found, as advised, that this claim was not correct, and they required to disclaim it in order that they might go on with their action. His Lordship would observe that they had proceeded at once to disclaim the part of the complete specification which they were advised was not good; and he only need add that some little time must elapse before it could be done. He might require to come back to his Lordship to get an order to disclaim, but he had not yet considered whether or not it should be done at this stage.

Mr. MILLAR thought the motion came somewhat late, seeing that the record was closed on the 17th of March. Unfortunately, they had not got their adjustments from the other side. His Lordship would notice that the defenders had this plea—that the alleged letters patent were invalid in respect of disconformity between the provisional and the complete specification; and it was only now that, for the first time, his friend had come forward and suggested a disclaimer. In the action, too, the defenders alleged that in a cause which was brought by the pursuers in England, against the Corporation of Brighouse, a similar question was raised upon the same patent; and in that action, after it had proceeded as far as proof, it was ordered, on March 21, 1901, on the application of the plaintiffs, that the defendants should have their costs paid as taxed. In other words, his friend's clients brought an action on the same grounds on this patent, and instead of disclaiming then in respect of this particular matter, as they might have done, if they had thought that they could thus amend their patent, they failed to do so, and paid the costs of the defendants. It was only two or three months after the closing of the record that his friend had come to ask for a disclaimer. He thought the motion should be refused, in the first place in respect of delay, and in the second place because the action would not now avail the pursuers as against the defenders. The former sued, in the first place, for damages for infringement of a patent which his friend now admitted was not a valid one. The disclaimer which was proposed would necessarily invalidate the whole patent, because, according to patent law, if one claim in a patent was bad, the whole patent went by the board. The position simply was this—that his friend now admitted that his patent was bad, and yet he was in Court with an action for infringement of that patent. Therefore he could not claim damages for infringement of a patent he admitted to be bad. The interdict, again, would fall with the patent. His friend would have to amend his interdict so as to make it an interdict of the amended patent. If he were allowed to amend, it should only be upon the most stringent conditions. There was authority for this. In the case of *Meyer v. Sherwood*, 1890 (7 Patent Cases, p. 283), Mr. Justice Smith laid it down that this was the law.

Lord Low pointed out that it was only one part of the claim which it was proposed to disclaim.

Mr. CRAIGIE agreed that this was so, and it was part of the patent on which the pursuers did not found.

Mr. MILLAR contended that the one claim was inseparable from the other. The whole merit of the alleged patent was that they could charge retorts by using the force of gravity, and the part of the patent which it was sought to disclaim was that in which a shield was placed in the mouth of the retort, by which the coal was let down quickly, and did not come in contact with the tar at the mouth. His friend must either put in a new specification or found on the one he had. If his Lordship saw fit, in any view, to grant the application, he submitted, on authority, that it should be done under the conditions that his friend should not be allowed to use the amended specification in evidence in any question of damages; that he should be required, within fourteen days, to proceed with the amendment; and that he should pay the expenses incurred. He moved that his Lordship should dismiss the action.

Mr. CRAIGIE thought it was premature to decide whether he was liable in expenses because the Court had not before it any material on which to judge the question of expenses. The English cases referred to had really no bearing on the present one, because there was a difficulty in England about amending the summons, while in Scotland there was none. His friend would not suffer in the least by the sist he asked, because they had not got interdict against him; so that really he would be allowed to go on using the patent as he was doing until the disclaimer was put in.

Lord Low: I am not in a position to judge just now whether this action would be of no use at all after the disclaimer suggested is made. It may be that a competent amendment of the action would make it fit for trial of the question of whether the defenders have been infringing the patent, even after the disclaimer. On the other hand, it might turn out that the disclaimer had made such an alteration in the patent that a totally new question was raised, which should not be tried in this action. If there is any chance of the question of the validity of the patent, after the disclaimer, being tried in this action, it would be unfortunate for both parties that the action should be thrown out at this stage, because it would create unnecessary expense, and it would mean a long delay before the question could be finally settled. If the case had been down for proof this session, I should have been compelled to consider seriously the motion for a sist in order that the pursuers might bring a disclaimer; but the case is not down for proof this session, and the ordinary course of matters would be to put it down for next session, in its order. That will give the pursuers ample time to go to the Patent Office to get their disclaimer; and then they would require to come to the Court and ask leave to amend their pleadings. It is pretty clear they would require to do this; and after that was done, the whole question could be raised whether or not there had been an infringement of the patent. What I propose to do is simply to put this case out, in ordinary course, to fix a proof for next session. If the specification be amended, and if it be found that the amendment of the summons and condescendence is competent to have the question tried under this summons, then the parties will have a day set apart for proof next winter, and the matter will be settled then. If, on the other hand, the amendment is not allowed, then it is clear that the action will be thrown out—also next session—and there will be an end of the question. So I do not propose to pronounce any order at all to-day; but I will put the case out for an order for proof, and I will hear the parties upon any question which may arise, after the disclaimer is made.

MISCELLANEOUS NEWS.

PLYMOUTH AND STONEHOUSE GAS COMPANY.

A Satisfactory Year's Working.

The Annual Meeting of this Company was held on Thursday last—Mr. J. A. BELLAMY presiding.

The Directors in their report congratulated the proprietors on the continued success of the undertaking. The price of gas was reduced from 2s. to the old rate of 1s. 9d. per 1000 cubic feet, as from the 31st of March, 1902. This lower charge accounted for the smaller amount received for gas in the past year than in the previous year, although the quantity of gas sold was much greater at the lower rate. After payment of the authorized dividend in January last, interest on debenture stock and to bankers, and carrying £2236 19s. 1d. to the suspense account (which is thereby closed), there remained to the credit of profit and loss the sum of £22,469 1s. 10d., from which the Directors recommended payment of a dividend for the half year ending the 31st of March last of 6½ per cent. on the ordinary stock, 9s. 9d. per share on the "additional shares," and 9s. 3d. per share on the "new shares, Act 1879," less income-tax. This would absorb £8781 8s.; leaving a balance of £13,687 13s. 10d. to be carried forward to the credit of the next account. Very favourable freight and coal contracts had been entered into for the current year. It was explained at the special meeting in February last, when the proprietors sanctioned the further issue of ordinary stock, that it was necessary to raise capital, not only by reason of the expansion of the Company's business generally, but to meet the expenditure on plant now being erected at the works for lessening the cost of gas production. This plant, which is thoroughly up-to-date in its design, would, it was believed, give results that would greatly improve the value and stability of the Company's business. The Bill for enlarging the powers of the Company had been read a third time in the House of Commons, and now only awaited the Royal Assent. The Directors recorded with great regret the retirement from the Board of Mr. Joseph Wills (late Deputy-Chairman), in consequence of failing health and advanced years, after being associated with the Company, as a Director, for forty years. To fill the vacancy on the Board, the Directors had elected Mr. T. G. Greek Wills; and Mr. John H. S. May had been elected Deputy-Chairman of the Company. From the revenue account, it appeared that the receipts were £108,245, as compared with £118,766 last year. The amount received by the sale of gas was £81,780, compared with £91,840; rentals, stoves, and meters, including automatics, £6298, as against £6148; residuals, £19,735, as compared with £20,306. The expenditure was £84,991, as against £96,998 last year. This was distributed as follows: Manufacture of gas, £71,752, as against £84,934; distribution, £5338, as compared with £5229; public lamps, lighting, and repairs, £372, as against £400; rates and taxes, £2401, as against £2190; management, £4297, as against £3595; law and parliamentary charges, £508, as against £26; interest on deposits, £120, as against £100; and bad debts, £200.

The CHAIRMAN, in moving the adoption of the report, said last year's working was the best they had had for a long time. With regard to the capital account, in 1898 their capital, including money drawn from the bank and used in the business, amounted to £253,816; this year it was £351,093. The profit in 1898 was £13,140; in 1899, £12,065; and this year it was £25,253. This gave a return on the capital in 1898 of 5¼ per cent., in 1899 of 4 per cent., and in 1903 of 7¼ per cent. So that, with £100,000 of additional capital, and in spite of the opposition of the electric light, they had increased the profit over 1898 by 41 per cent., and over 1899 by 81 per cent. These figures were very striking. It had meant work all round. Such results did not grow of themselves, but called for a good deal of thought and of devotion to the business on the part of the officers and Directors. To bring the matter right up to date, he might say that the output of gas last week showed an increase over the corresponding week of last year of 5·79 per cent. When they saw the number of shops and private houses in which the electric light was being used, as well as the public lighting by electricity, this increase must be considered remarkable. The Corporation were receiving about £8000 a year for electric light. This was supplied at the expense of the Gas Company; for although he did not suppose that they would have received the £8000, a large portion of it would have been added to their revenue if there had been no electric light. However, they did not complain of the competition; all they asked was that it should be fair. The Company paid one-eightieth part of all the rates of Plymouth—a sum equal to a penny rate on the assessment of the whole town; and he thought this gave them a right to expect that the electric light should not be supplied at a loss. When, as was sometimes suggested, there was a heavy outlay to supply one consumer, when mains were extended at a cost of £100 to get a profit of perhaps 10s. per annum, he did not call that fair competition. It must, in fact, involve a heavy loss to the ratepayers; and a considerable proportion of that loss fell on the shareholders of the Company. Personally, he had not the slightest fear for the future of the gas undertaking, provided they met with fair, level competition. An ugly feature which had been in the accounts for some time in the form of a suspense account had this year been entirely wiped out. It came about through expensive litigation, the cost of which it was thought advisable to work off gradually; and he was glad to say it had now entirely disappeared from the accounts. Increased output meant, of course, putting up more plant; but increased capital did not mean of necessity less profit to divide. The capital now being laid out would, in fact, mean greater economy in the manufacture of the gas. An important feature of the year had been the Bill promoted by the Company in Parliament. In regard to this, they had been fairly met by the Corporation. Upon his invitation, the representatives of the Corporation consented to sit down and talk the matter over on business lines. It was the Corporation's duty to see that there was nothing in the Bill prejudicial to the ratepayers as a body; and on behalf of the share-

holders, the Directors had to see that the Company received fair treatment. Originally, the Company had intended to apply for a reduction of illuminating power of the gas from 15 to 13 candles; but they found that this would involve a reduction of the standard price of 2s. 6d., and they came to the conclusion that, at the low price at which they supplied gas (1s. 9d. per 1000 cubic feet), this would not pay them. Therefore, they amended their application to a reduction to 14 candles. This was known to the Town Clerk; and although the technical advisers of the Corporation suggested that 13 candles with a penny off the standard price would be the better arrangement, the Corporation decided not to oppose the reduction in the candle power for which the Company asked. They were the only gas company in the country who had succeeded in getting the illuminating power reduced without having to lower the standard price. They might congratulate themselves upon that, and upon having shown the way to other companies. They had also taken power in the Bill to supply gas outside the borough limits at an increased price, which, however, was still so low in comparison with any possible competitor that the probable consumers were perfectly satisfied with the arrangement. It was not intended that those powers should be a dead letter. Tramways were to be laid to Crown Hill; and advantage would be taken of that to lay the mains to that district. It was hoped to make an arrangement, either with the Corporation or the Railway Company, to carry the mains, by one of the existing bridges, over the Laira River for the supply of Plymstock. The new plant was capable of supplying all those demands; and a larger output meant an increase in the profits. Part of their satisfactory result had been brought about by improved methods of gas manufacture and by greater profit on residuals. Advance had been made in every direction; the duty of the Directors being to watch every improvement and to see that they were one of the first half-dozen companies to take in hand any invention that promised to be successful. They did not intend to wait twenty years to see what a thing was worth. They investigated right away; and if they found it worth while, they adopted the improvement. This policy had been fully justified by results. With regard to the gas industry as a whole, there was a great lack of what he might call the co-operative spirit among the gas companies of the country in the offering of inducements to inventors. He had had conversations on the subject with one or two of the leading experts, who agreed that it was desirable that something should be done in this direction; and he hoped the gas journals would take the matter up and get the gas companies to co-operate in offering substantial prizes for special kinds of invention. One thing very badly needed was something inexpensive and effective to combine with the gas-cooker to supply hot water throughout the house. To his mind, this problem had not yet been solved in a satisfactory way; and it would be worth the gas companies' while to subscribe a handsome sum to the man who would bring out a scheme by which the household should be able not only to do its cooking by gas, but should be also supplied with hot water. Something ought also to be done to prevent the soiling of ceilings. Possibly a method might be discovered by which the portion of the decoration over the gas might be made removable. At all events, in this or some other direction, there was a field open for invention. In competition with the electric light, this was one of the things they had to meet. People admitted that the electric light was dearer, and that there were also other disadvantages; but then they said: "We do not have discoloured ceilings." This was certainly an objection to gas lighting for certain purposes which they had to meet, and, if possible, overcome. Before sitting down, he wished to thank the Directors for their loyal co-operation. He thanked also the Secretary and the Engineer. The Engineer was a young man; but he (Mr. Bellamy) had great faith in a young man who put his back into a big undertaking. Their appointment of Mr. Hoyte had been amply justified by results. He was devoted to the interests of the Company, and lost no opportunity of working out things to a practical issue. He cordially thanked Mr. Hoyte for his co-operation, and was sure he had a distinguished future before him. The Directors were also under a sense of obligation to their workmen. With friendly feelings and good-hearted co operation, better results had never been attained than now; and it was proposed to recognize that in this form: It had long been felt that the accommodation of the men at the works in the shape of a mess-room, lavatory, baths, &c., was defective; and it had been resolved to put up a place for the purpose on modern lines, so that they might make their workmen as comfortable as they could.

Mr. J. H. S. MAY, the Deputy-Chairman, seconded the motion, and said that, as Chairman of the Finance Committee of the Board, it was a particular pleasure to him to know that they had a credit balance at the bank on current account.

Mr. A. R. BROWNING, who was frequently interrupted, and heard with much impatience, criticized some details of the management, and suggested that the Directors ought to follow the usual custom of publicly inviting tenders for coal and for engineering work.

The CHAIRMAN said that the Company had made satisfactory tenders for coal and oil. As had always been done, the Chairman and Secretary went to the North and bought coal; and no company had bought either coal or oil more advantageously. As to Mr. Browning's suggestion that the capital should not have been increased, it was sufficient to point to the large amount which had been laid out in consequence of the extension of the business in gas-stoves.

Mr. P. GENTLE expressed his satisfaction with the remarks as to the good relations of the Company and their workmen; and he asked if Sunday labour was reduced to a minimum.

The CHAIRMAN said that it was. Some time ago they tried to do away with Sunday labour; but it was found impracticable. The men were perfectly satisfied with the present arrangement, which was made as convenient for them as possible.

The report and balance-sheet were adopted, the dividends recommended declared, and the retiring Directors re-elected.

The CHAIRMAN announced that the £10,000 of stock recently offered had been taken up locally, which the Directors thought very satisfactory, as they were anxious that the stock should be in the hands of the consumers. There would be another issue of stock shortly, and then probably no more for many years.

Mr. HANNAFORD moved—"That, in recognition of the valuable service rendered by the Chairman of the Company, the special honorarium of £300 a year voted him at the last annual meeting be increased to £400." He said that this sum was the same amount as was allowed to the late Chairman, under whom the business was much less, and that Mr. Bellamy's ability and business qualities largely contributed to the increasing prosperity of the Company.

Mr. R. WOOLLAND seconded the motion, which was carried.

The CHAIRMAN, in returning thanks, said that he had given the Company as much time and attention as if it were his own business.

REPORT OF THE CHIEF INSPECTOR UNDER THE ALKALI ACTS.

As mentioned in the last number of the "JOURNAL," the report for the past year of the Chief Inspector under the Alkali, &c., Works Regulation Acts, 1881 and 1892 (Mr. R. Forbes Carpenter), was published on the 22nd inst.—some weeks earlier than that for the year 1901. As usual, it contains much matter of interest to our readers; and we therefore commence to-day an abstract of it.

The number of works now registered under the Acts in England, Ireland, and Wales is 1044, compared with 1036 and 1054 in 1901 and 1900 respectively. Of these, 75 only are works decomposing salt, and so scheduled as alkali works; while in the remainder are carried on processes scheduled under the Acts. These numbers show a reduction of 8 alkali works, and an increase of 16 scheduled works, in the past as compared with the preceding year. There are also 124 works registered in Scotland; bringing up the total number of works in the United Kingdom to 1168. The report now under notice is made to the Local Government Board; but, as before, it is followed by one on Scotch works, presented to His Majesty's Secretary for Scotland. The Inspectors paid 4946 visits to works, and carried out 5091 tests, compared with 5013 visits and 5431 tests in the year 1901. Mr. Carpenter again expresses his satisfaction at being able to report that no proceedings were entered for recovery of penalties provided in the Act of 1881 for infraction of the limit clauses, or for failure to use the best practicable means for the prevention of the escape of noxious and offensive gases. This result in one case, was only reached by the suspension of the severer measures pending the immediate remedying of the causes that gave rise to most serious complaint.

A large portion of the section of the report in which Mr. Carpenter deals with sulphuric acid works is occupied with an examination of the methods employed in estimating the total acidity of the gases escaping from the chamber process, with some suggestions arising from the study of the interaction of nitrous and sulphurous acids, or the salts thereof, in aqueous solution. These subjects received some very close attention by him during the past year. In the early months there were submitted to him by Mr. Curphey, the Inspector for Scotland, some marked differences in titrations of solutions in which the acid gases had been absorbed, according to the nature of the absorbent used. It was considered essential, therefore, not only that the methods employed should be investigated, but that the reactions themselves should be closely and critically studied. A prolonged investigation of the latter led to very exact and interesting conclusions. The knowledge thus obtained, when applied to conditions existing in actual manufacture, and to samples derived from working experience, showed the justification of the long preliminary investigations in the laboratory. Mr. Carpenter's Assistant (Mr. Linder) was so intimately associated with the work from its inception, and the Chief Inspector was so much indebted to the skill and energy displayed throughout the whole investigation—the carrying out of the experiments decided upon devolving entirely upon him—that he desired that Mr. Linder's name should be associated with his own by presenting a joint paper to the Society of Chemical Industry. This appeared on Dec. 31, 1902, in the "Journal" of the Society; and, as it was primarily prepared for the report, it is reprinted with a very few alterations. Those of our readers who are specially interested in these valuable researches should study *in extenso* the results of the authors' combined labours.

We now pass on to the portion of the report treating of works employed in the production of sulphate and muriate of ammonia and the treatment of gas liquor. More will be said concerning these operations when we deal with the reports of the District Inspectors. The works registered for the purposes named form by far the largest number of any operations scheduled under the Acts, amounting last year to 459 works where ammoniacal liquors are dealt with. In 421 of these the manufacture is that of sulphate or muriate of ammonia. The latter salt (made in very few works) is in demand chiefly for galvanizers' use; in the form of salammoniac it is exported to the Continent; and only a minor proportion is used in home industries. Sulphate of ammonia is the principal salt of ammonia manufactured. No novel features in the treatment of the foul gases evolved in the distillation of ammoniacal liquor call for notice; but three of the District Inspectors (Dr. Fryer and Messrs. Young and Sutton) make special reference to the neutralization results obtained last year. In works where purification by oxide of iron has become one which it is desired to replace by an alternative method, the neutralization, in limestone-filled towers, of the sulphurous acid formed by combustion of the sulphuretted hydrogen, is one that has commended itself to some manufacturers whose works are so placed that no subsequent difficulties arise from the disposal of the weak solution of calcium bisulphite, sulphite, and sulphate formed in the tower.

In regard to the recovery of ammonia and tar from coke-ovens, to which in the last few years increasing attention has been paid, Mr. Carpenter says that improvements in machinery, on the lines indicated in previous reports as taking place, received further extension last year. There is, however, at present no prospect, except in one district, of new recovery plants being forthwith erected. An important contribution to the chemistry and physics of the coke-oven was made last

year, in a paper read before the German Association of Gas and Water Engineers by Herr Hilgenstock, of Dahlhausen, where Dr. Otto's system of recovery coke-ovens was first worked out, and where very considerable experience has been accumulated from the days of the Coppée oven onwards, through those of the Otto-Hoffman (with regenerators connected with the oven), to the present form, known as the "under-fired oven," or the Otto-Hilgenstock pattern, in which regeneration is dispensed with—the complications connected therewith having been proved to produce disadvantages and irregularities in the coking process greater than the economical advantages of heat saving. For the particulars he gives in regard to Herr Hilgenstock's researches, Mr. Carpenter acknowledges his indebtedness to the abstract translation of his paper given in the "JOURNAL" for the 28th of October last.

A specially interesting feature of these annual reports is the table showing the quantity of sulphate of ammonia produced in the United Kingdom, which Mr. Carpenter is able, through the courtesy of manufacturers, to compile. The following are the figures for the past and the two immediately preceding years :—

—	1902.	1901.	1900.
Gas-works	150,055	142,703	142,419
Iron-works	18,801	16,353	16,959
Shale-works	36,931	40,011	37,267
Coke-oven works	15,352	12,255	10,393
Producer gas and carbonizing works (bone and coal)	8,177	5,891	6,688
Total	229,316	217,213	213,726

Mr. Carpenter points out that the most important contributor, of course, remains the gas industry. It will be noticed that the figures show a very decided increase over those for 1901—a result which was hardly anticipated when the known increase of water-gas installations in different parts of the country was taken into consideration. The produce of gas-works in England, Ireland, and Wales shows a decided increase. Scotland again shows a marked increase. Ireland, taken alone, while still exhibiting a decrease from the figures for 1900, shows an increase over 1901. There are very satisfactory increases in the amounts recovered from producer gas and from coke-ovens. The industry of coal-carbonizing, in connection with ammonia and benzol recovery, is still depressed; the reduction in activity as compared with 1900 being marked. Mr. Carpenter thinks the increase in the quantity of sulphate recovered from producer gas is one that may be expected to continue with the development of such central stations for the supply of power gas as are now either in course of construction or in contemplation. In connection with this subject, some tabulated analyses of ammoniacal liquors are given.

Coming to tar-works, Mr. Carpenter points out that the distillation of tar still remains by far the most widely-spread process of which the supervision was added to the duties of the inspecting staff by the Act of 1892; the number of works where tar distillation or heating in any manufacturing process is carried on remaining at 128. No modification of importance in the processes employed during the past year calls for comment. Unfortunately, there were two fatalities to men engaged in the operation of cleaning stills; and in each case two lives were lost. It is five years since a fatality attending this operation occurred. Mr. Carpenter remarks that it has been found very difficult to impress on manufacturers and their managers and foremen the necessity of making complete physical disconnection of the still to be cleaned from any other stills that may be working at the time. He points out that all pipes should be detached from those communicating with other stills. The rule should be observed that the turning of a tap to shut off connection is quite an insufficient safeguard against accident. Joints should be actually broken before men are allowed to enter a still.

Mr. Carpenter closes his report with a brief retrospect of the twenty-one years during which the Act of 1881 had been in force up to last year. The reports of the District Inspectors, as usual, follow that of their Chief. These will be noticed in subsequent issues.

NEXT YEAR'S EXAMINATIONS IN GAS MANUFACTURE.

The programme of the technological examinations of the City and Guilds of London Institute for 1903-4 was issued last Thursday by Mr. John Murray, Albemarle Street, W. Those of our readers who are desirous of making a start in the profession of gas engineering armed with a certificate from the Institute as a voucher for, at all events, some theoretical knowledge of the business, will find from the programme that the date fixed for the examinations in the subject of "Gas Manufacture" is Saturday, April 30, 1904, from 2.30 till 6 30, and the questions they will be expected to answer will be founded on such subjects as the following :—

HONOURS GRADE.

(1) The characteristic properties of the various kinds of coal, and their value for gas-making purposes. (2) The effects of temperature upon the production of residuals. (3) The chemical composition of coal gas, and the effect of each component upon the illuminating and calorific power of the gas. (4) The principles of combustion, and their application to the working of retort-furnaces. (5) The more advanced physical and chemical principles involved in the processes of destructive distillation of coal, and in the condensation and purification of the resulting gas. (6) The methods of gas analysis, including those for ascertaining the amount of the impurities in the crude gas. (7) The

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 945.

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
590,000	10	April 17	10½	Alliance & Dublin 10 p.c.	19—20	..	5 5 0
100,000	10	,,	7½	Do. 7 p.c.	13—14	..	5 7 2
200,000	5	May 14	6⅔	Bombay, Ltd.	5½—6	..	5 8 4
140,000	5	,,	6½	Do. New, £4 paid	4—4½	..	5 15 7
380,000	Stk.	Feb. 26	12	Brentford Consolidated	240—245	..	4 18 0
286,700	,,	,,	9	Do. New	178—183	..	4 18 4
50,000	,,	,,	5	Do. 5 p.c. Pref.	131—136	..	3 13 6
206,250	,,	June 11	4	Do. 4 p.c. Deb.	108—111	..	3 12 1
220,000	Stk.	Mar. 12	10 and 2½	Brighton & Hove Orig.	212—217	..	4 19 1
246,320	,,	,,	7	Do. A. Ord. Stk.	151—156	..	4 19 4
460,000	20	Mar. 31	10	British	39½—40½	..	4 18 9
100,000	Stk.	Mar. 12	6	Bromley, 5 p.c. "A"	118—123	..	4 17 7
165,700	,,	,,	4½	Do. 3½ p.c. "B"	90—95	..	4 14 9
500,000	10	May 14	7	Buenos Ayres (New) Ltd.	11—11½	..	6 1 9
250,000	Stk.	June 26	4	Do. 4 p.c. Deb.	93—95*	+1	4 4 3
150,000	20	Mar. 12	8½	Cagliari, Ltd.	23—25	..	6 12 0
100,000	10	June 11	10	Cape Town & Dis., Ltd.	14½—15½	..	6 9 0
50,000	50	May 2	6	Do. 6 p.c. 1st Mort.	52—54	..	5 11 1
1,375,000	Stk.	Feb. 26	5	Commercial 4 p.c. Stk.	103—106	..	4 14 4
503,750	,,	,,	4⅔	Do. 3½ p.c. ,,	98—101	..	4 14 1
407,812	,,	June 11	3	Do. 3 p.c. Deb.,,	87—90	..	3 6 8
800,000	Stk.	June 11	8	Continental Union, Ltd.	125—130	..	6 3 1
200,000	,,	,,	7	Do. 7 p.c. Pref.	137—142	..	4 18 7
575,000	Stk.	Feb. 26	5⅛	Crystal Palace Ord. 5 p.c.	113—118	..	4 10 2
60,000	,,	,,	5	Do. 5 p.c. Pref.	120—125	..	4 0 0
106,158	,,	Jan. 15	5	Do. 5 p.c. Deb. Stk.	137—140	..	3 11 5
486,090	10	Jan. 29	10½	European, Ltd.	18—19	..	5 10 6
354,060	10	,,	10½	Do. £7 10s. paid	13—14	..	5 12 6
15,243,200	Stk.	Feb. 12	4⅛	Gas-light and Coke	4 p.c. Ord.	84—86	—1	5 2 4
2,600,000	,,	,,	3⅜		3½ p.c. max.	85—87	..	4 0 6
3,799,735	,,	,,	4		4 p.c. Con. Pref.	107—109	—1	3 13 5
4,193,975	,,	June 11	3		3 p.c. Con. Deb.	87—89	+1	3 7 5
252,500	Stk.	Mar. 12	5	Hastings & St. L. 3½ p.c.		90—95	..	5 5 3
70,000	10	June 11	8	Hongkong & China, Ltd.		15—16	..	5 0 0
3,800,000	Stk.	May 14	10	Imperial Continental		205—208	..	4 16 1
473,600	Stk.	Feb. 12	3½	Do. 3½ p.c. Deb. Red.		100—103	..	3 8 0
165,242	Stk.	Mar. 12	6	Lea Bridge Ord. 5 p.c.		115—120	..	5 0 0
561,000	Stk.	Feb. 26	10	Liverpool United A		218—220	..	4 10 11
718,100	,,	,,	7	Do. do. B		166—168	..	4 3 4
306,083	,,	June 26	4	Do. do. Deb. Stk.		110—112*	..	3 11 5
75,000	5	June 11	5	Malta & Medn., Ltd.		4¼—4⅜	..	5 5 3
560,000	100	April 1	5	Met. of Melbourne	5 p.c. Deb.	103—107	..	4 13 6
250,000	100	,,	4½		4½ p.c. Deb.	102—104	..	4 6 7
541,920	20	June 11	3⅜	Monte Video, Ltd.		9½—10½	..	6 13 4
1,515,892	Stk.	Feb 20	4½	Newc'tle & G'tesh d Con.		104—105	..	4 5 9
376,855	Stk.	Jan. 2	3⅜	Do. 3½ p.c. Deb.		96—97	..	3 12 2
300,000	Stk.	May 14	8	Oriental, Ltd.		140—145	..	5 10 4
600,000	5	Mar. 31	7	Ottoman, Ltd.		6—7	..	5 0 0
				* Ex div.			

Issue.	Share.	When ex-Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.	GAS COMPANIES.			£ s. d.
205,005	Stk.	June 26	6½	Ply'mth & St'house 5 p.c	125—130*	+1	4 14 3
851,070	10	April 30	7	River Plate Ord.	11—11½	..	6 1 9
300,000	Stk.	June 26	4	Do. 4 p.c. Deb.	94—96*	..	4 3 4
250,000	10	April 17	8	San Paulo, Ltd.	11⅞—12½	..	6 8 0
135,000	Stk.	Mar. 12	10	Sheffield A	239—241	..	4 3 0
209,984	,,	,,	10	Do. B	237—240	..	4 3 4
523,498	,,	,,	10	Do. C	237—239	..	4 3 8
103,235	Stk.	Mar. 31	5	Shrewsbury Ord. 5 p.c.	111—114	..	4 7 9
6,000,000	Stk.	Feb. 12	5½	South Met., 4 p.c. Ord.	119—122	..	4 7 4
1,780,000	,,	Jan. 15	3	Do. 3 p.c. Deb.	50—92	..	3 5 3
380,940	Stk.	May 14	5	Southampton Ord.	105—110	..	4 10 11
87,950	,,	Jan. 15	4	Do. 4 p.c. Deb.	103—106	..	3 15 6
120,000	Stk.	Feb. 26	6	Tottenham and Edmonton	A. 5 p.c.	117—122	..	4 18 4
300,520	,,	,,	4½		B. 3½ p.c.	96—99	..	4 10 11
182,380	10	June 11	8	Tuscan, Ltd.		8—9	..	8 17 10
149,900	10	Jan. 2	5	Do. 5 p.c. Deb. Red.		99—101	..	4 19 0
730,872	Stk.	Mar. 12	5	West Ham, 5 p.c. Ord.		95—100	..	5 0 0
				WATER COMPANIES.			
780,776	Stk.	June 26	11½	Chelsea, Ord.		320—330*	..	3 9 8
150,000	,,	,,	5	Do. 5 p.c. Pref.		147—150*	..	3 6 8
160,000	,,	,,	4½	Do. 4½ p.c. Pref. '75		135—138*	+3½	3 5 3
175,785	,,	Mar. 31	4½	Do. 4½ p.c. Deb.		137—142	..	3 3 5
1,720,560	Stk.	Mar. 31	8	East London, Ord.		244—249	—1	3 4 3
654,740	,,	June 11	4½	Do. 4½ p.c. Deb.		138—143	..	3 2 11
1,282,943	,,	,,	3	Do. 3 p.c. Deb.		94—96	..	3 2 6
700,000	50	June 11	10	Grand Junction	10 p.c. max.	140—143	..	3 9 11
310,000	Stk.	Mar. 31	4		4 p.c. Deb.	123—128	..	3 2 6
708,000	Stk.	Feb. 26	10½	Kent		300—310	..	3 7 9
160,000	,,	,,	7	Do. New, 7 p.c. max.		200—210	..	3 6 8
1,043,800	100	June 26	11	Lambeth, 10 p.c. max.		310—320*	—4½	3 8 9
406,200	100	,,	8½	Do. 7½ p.c. max.		220—230*	—2¾	3 13 11
350,000	Stk.	Mar. 31	4	Do. 4 p.c. Deb.		122—127	..	3 3 0
500,000	100	Feb. 12	12⅝	New River, New Shares		430—440	..	2 18 2
1,000,000	Stk.	Jan. 29	4	Do. 4 p.c. Deb.		123—128	..	3 2 6
902,300	Stk.	June 11	7½	South-wark and Vauxhall	Ord.	277—282	+4	2 13 2
126 500	100	,,	7½		7½ p.c. max.	210—220	..	3 8 2
489,200	Stk.	,,	5		5 p.c. Pref.	148—153	..	3 5 4
1,019,585	,,	Mar. 31	4		4 p.c. A Deb.	122—127	..	3 3 0
1,155,066	Stk.	June 11	10	West Middlesex.		303—308	..	3 4 11
200,000	,,	,,	4½	Do. 4½ p.c. Deb.		136—141	..	3 3 10
200,000	,,	Mar. 12	3	Do. 3 p.c. Deb.		94—96	—1	3 2 6
				* Ex div.			

practice of photometry, and determining of the calorific power of gas. (8) The best means of burning the gas in order to develop its illuminating power to the greatest advantage. (9) Labour-saving appliances in the retort-house, and the working of retorts. (10) The construction of gasholders, purifiers, and other gas apparatus. (11) The management of the various portions of the plant in order to obtain the best efficiency of the apparatus, with due regard to economy in working. (12) The method of dealing with such emergencies as are of more common occurrence in gas-works through breakdown of machinery or other failure of plant. (13) The working up of ammoniacal liquor. (14) The manufacture and purification of uncarburetted and carburetted water gas. (15) Methods of enrichment of coal gas by means of oil, &c. (16) Such important recent developments of the gas industry as have been fully described in the Technical Press.

ORDINARY GRADE.

(1) The construction of a retort or oven best adapted for the destructive distillation of coal. (2) The setting of retorts and the construction of retort furnaces. (3) The effects of temperature in modifying the quantity and quality of gas produced. (4) The description and arrangement of apparatus employed for the conveyance of the gas immediately upon its leaving the retorts. (5) Apparatus best adapted for cooling the gas and for removing the products of condensation. (6) The methods of removing the gaseous impurities from the cooled gas, including a description of the materials employed and the most suitable condition of the gas for effective purification. (7) The use of an exhauster. (8) The methods employed for controlling the pressure at the works, so as to secure an adequate supply of gas at the various points of consumption, with a due regard for economical effect. (9) The various instruments used in gas works for ascertaining and recording pressure and exhaust. (10) The laying of mains and service-pipes. (11) The construction and fixing of gas-meters, and the fitting up of premises for the supply of gas. (12) The various forms of gas-burners in general use. (13) The simplest methods of ascertaining the illuminating power of gas. (14) The simpler physical and chemical principles involved in the various processes of gas manufacture, and in the tests for ascertaining the illuminating power and purity of the gas and the value of the bye-products. (15) The practical method of carrying out these tests. (16) Influence of temperature and pressure on the volume of the gas.

Certificates are awarded on the results of each examination; but for the full technological certificate the candidate must also qualify according to the rules. The questions set at the last examinations were given in the "JOURNAL" for the 12th of May (*ante*, p. 390); and their perusal may be helpful to the student. The works recommended are set forth in the programme. The following prizes are open for competition: Ordinary Grade: (1) Salters' Company's prize of £1, and the Institute's silver medal; (2) do., and the bronze medal; (3) the bronze medal. Honours Grade: (1) Salters' Company's prize of £2, and the Institute's silver medal; (2) do., and the bronze medal.

FURTHER INSTALLATIONS OF THE KEITH LIGHT.

We learn that the James Keith and Blackman Company have just been favoured with some notable orders for installations of the Keith light. The South-Eastern and Chatham and Dover Railway Company have instructed them to light the whole of their Blackfriars Goods Depôt. This, when completed, will total 61,800-candle power, and will be driven by one of Keith's No. 5 patent automatic gas-compressors, the water being supplied from the hydraulic mains and reduced to a suitable pressure. The Birmingham Railway Carriage and Waggon Company have also shown their confidence in the light; for, after testing it with other forms of intensified lighting, and also against electric arc lamps, they have placed an order for an installation of 103,300-candle power. The whole of this will be under one roof; the majority of the lights being in units of 1000-candle power (reflector fittings), and will be placed at a distance of about 26 feet from the floor. The total area of this shop is about 109,000 square feet. As it is proposed that the light shall be extended to other shops now in course of erection, one of Keith's No. 6 compressors is being supplied. This machine is capable of passing 6000 cubic feet of gas per hour, and can be arranged for either water or power driving; in this case, it will be driven by water, with a minimum pressure of 30 lbs. per square inch. Another installation is one of some 30,000-candle power, to be fixed in the works of Messrs. Walter Macfarlane and Co., Saracen Foundry, Glasgow. The portion of their works they propose to light up is a new foundry, and in this case the burners will be arranged in hexagonal lanterns. The compressor will be one of the No. 4 size, which is capable of passing 1000 cubic feet of gas per hour.

ELECTRIC LIGHTING NOTES.

The Lichfield Lighting Scheme.

It appears that the Lichfield Corporation are determined to proceed with their application to the Board of Trade for an extension of their Electric Lighting Order, to which reference was made in the "JOURNAL" some weeks ago. At a recent meeting of the City Council, Mr. Andrews, the Chairman of the Electric Lighting Committee, moved a formal resolution to carry out the above-named object. Their proceedings in this matter will not, however, be of the smoothest; for the intention of the Corporation is to go outside their district, and enter a region where the Gas Company have power to supply any kind of illuminating agent, and, of course, their encroachment will be opposed. This was very unequivocally made known to the Council when the matter was recently before them. An attempt was made to show that the Company were not treating the Council fairly, inasmuch as when the original application for a Provisional Order was made,

Tower Scrubbers

STEEL OR CAST IRON. BOARD FILLING.

WRITE DIRECT TO

C. & W. WALKER, LTD.,

Midland Iron Works:
DONNINGTON, near NEWPORT,
SALOP.

London Office:
110, CANNON STREET,
E.C.

about three years ago, a promise was given that no opposition would be offered by the Company. Such a promise was, no doubt, justified at the time, or the Directors would not have made it. But things have changed since then; and there are now good and sufficient reasons for opposing what, in their opinion, will be an injudicious expenditure of the ratepayers' money on a scheme about which nothing is known outside the Committee. However, several councillors declared that they were not to be frightened by the threatened action of the Company; and at a special meeting convened for the purpose, the resolution was carried. A curious feature in this business is that the Town Clerk (Mr. H. Russell) is a Director and Solicitor of the Gas Company; and owing to this occupancy by him of a dual position with the Council's threatened opponents, a proposal will be made at the next meeting to appoint Mr. Ashmall as their Solicitor for carrying this application through.

Kingston's Heavy Burden.

The Kingston Town Council are trying their hardest to make the best of their electric light undertaking, the condition of which has been alluded to in the "JOURNAL" on several occasions. At a recent meeting, the Lighting Committee presented a report in which they referred to the recommendations of Mr. Henry Burstall, who has been advising them, in regard to effecting economy in capital and working expenditure, and specified the directions in which, after consultation with him, they thought this might be done. They advised a reduction of the charge on the indicator system, and the engagement of a convasser to solicit custom and explain the advantages of electric lighting. Finally, they said that, in view of the large amount of money now sunk in the works—some £80,000—and for the purpose of supporting the Committee and the Borough Electrical Engineer in their endeavours to make the undertaking a paying concern, they thought it would be a wise precaution to appoint an advising engineer, who should be required to exercise a constant supervision over the works; and they asked to be empowered to make such an appointment at a sum not exceeding £120 per annum for a term not exceeding three years. The report, and especially its concluding paragraph, gave rise to a long discussion. A definite issue was raised on an amendment, proposed by Alderman Salmon, that this paragraph should be deleted. He said that if their own Engineer (Mr. J. E. Edgcome) was not capable of carrying on the works, it was time he retired. It was a very inopportune moment to appoint such a man, because they were now getting into a better condition, and all the credit for the improved position would be claimed by the new adviser. Mr. Clarke, the Chairman of the Committee, replying on the discussion, reminded the Council that Mr. Edgcome came to them as a young man who had never had charge of any other station, and was not in a position to know what was going on all over the country. The £120 a year for an advising engineer was not a large sum; and if they had a gentleman to whom reports from the works would have to go weekly, they could not possibly lose £1017 again, because a leakage in any direction would be promptly detected and stopped. In the result, the amendment was defeated by 12 votes to 10, and the recommendations of the Committee were adopted.

The Bangor Electric Light Guarantees.

As was to have been expected, the Bangor Corporation have been taking steps to enforce the guarantees entered into by ratepayers, on the strength of which they decided to undertake a municipal electric lighting scheme (*ante* p. 467). So far, however, their efforts in this direction have not been rewarded with a great amount of success; the defendants, when before the County Court Judge, having made various excuses for the non-fulfilment of their promises. In one case, a Mr. Griffiths admitted having signed an agreement to take 400 units of electricity per annum for five years. He was at that time residing at the King's Arms, of which his wife was licensee; and the reason he did not take the current was because his wife would not allow him. The amount claimed was £10 8s. 4d., which represented the sum due for fourteen months. For the defence, it was objected that the agreement under consideration was one which ought to have been an agreement under seal. It did not comply with section 20 of the Electric Lighting Act of 1882, which was directed against undue preference; and it was bad because there was no consideration shown for it. His Honour (Sir Horatio Lloyd), in giving judgment, said he did not think that the contention that the agreement should be under the seal of the Corporation applied in this case; and the question of "no consideration" was not a good ground of defence. Referring to the terms upon which the Corporation were bound to supply electrical energy, he remarked that, as far as this was concerned, the defendant could not get out of the agreement he had signed. The only real question in the case was that of the measure of damage. A formal three months' notice of the Corporation being in a position to supply the guarantor with electrical energy was issued by the Town Clerk on April 26, 1901. Consequently, th se who had signed the agreement would not be responsible until July 26 of that year. It therefore appeared to him that the defendant was only liable for the amount which covered the period from July 26 to Dec. 31, 1901. He gave judgment accordingly for such amount, with costs on the ordinary scale. In another case, Mr. Richard Davies, an architect, pleaded that he got in his supply too late, and was not therefore able to consume the amount guaranteed. The sum in dispute was £2 1s. 8d. Mr. Davies said that, in spite of starting late, he had taken over double the quantity of energy he had guaranteed to take under the agreement. He also produced a letter from the Town Clerk's office, the date of which his Honour held materially affected the claim against him. The claim of the Corporation therefore failed. In a third case, Mr. Warlski, a draper, signed the guarantee bond promising to take 500 units of electricity per annum for five years. Defendant stated that he was the owner of two premises in High Street; and he contended that between the two he had consumed more electricity than he had actually guaranteed to take from the Corporation. After hearing the evidence, his Honour found in favour of the defendant, for whom judgment was given, with costs on the ordinary scale.

A
PLAIN
FACT
IN
PLAIN
TYPE.

WRIGHT'S
"EUREKA"
COOKERS
ARE
UN-
SURPASSED.

CHELSEA WATER-WORKS COMPANY.

The Half-Yearly General Meeting of this Company was held at the Office, Commercial Road, Pimlico, on Thursday, under the presidency of Mr. Francis Stephen Clayton.

The Secretary (Mr. G. H. Gill) having read the notice convening the meeting and the report of the Company's Auditors,

The Governor stated that the accounts for the half year ended March 31 were of a satisfactory character, and amply justified the Directors in recommending a dividend at the same rate as was paid the previous half year—namely, 11½ per cent. After paying this dividend, and providing for the interest on the debenture and preference stocks, the handsome sum of £40,196 remained to be carried forward. The expenditure on capital account in the period under review had been £330. There had been an increase of £2015 in the half year in the amount carried to dividend and interest account for transfer of profits, as compared with the amount carried to that account in the corresponding period of last year. The quantity of water pumped during the half year had been 26 million gallons more than in the same period of 1902. This had been caused chiefly by the increased quantity of water supplied by meter—in fact, the revenue from meter supplies showed an increase of £912 over the amount received from this source in the March half of the previous year. During the six months, 203 new supplies had been laid on; and these were estimated to produce £639 per annum. The sum of £23,482 of 3 per cent. debenture stock had been created and issued in conformity with the resolution passed at the extraordinary general meeting held in February last. This stock was required to cover the expenditure incurred by the Company on intercommunication works. The interest on it would be borne and paid by the associated London Water Companies; and he might also state that the stock was exempt from any payment for sinking fund to the City Chamberlain. The Metropolis Water Act of last year received the Royal Assent on the same day as that on which the last half-yearly meeting of the Company was held—Dec. 18. Since then, the Water Board had been formed, and the Arbitrators had held a preliminary sitting. The statement of claim of this Company had already been delivered to the Court of Arbitration. It had been prepared with great care, and under the best available advice. The Court of Arbitration had fixed Monday, Oct. 26, for their first sitting on the Companies' claims. The case of the East London Company would be taken first and that of the New River Company next. Their own case was seventh on the list. If their career had not been cut short by the Metropolis Water Act of last year, the Company would have had a grand future before them. The old houses in Chelsea and Westminster were gradually disappearing, and were being replaced by fine new buildings of greater size and importance. It was no exaggeration to say that the increase of water-rental resulting from this transition was at least three times the amount of the old rate. In addition, their meter supplies were constantly increasing, and were a source of considerable profit—in fact, one-third of the Company's water revenue proceeded from meter supplies. He might add that, besides the normal increase under this head, there would before long be some new supplies of an important character, which would add materially to the revenue. The proprietors might rest assured that no pains would be spared to put the Company's case fully before the Court of Arbitration in all its bearings. Their able Solicitor, Sir John Hollams, had the matter in hand; and the Directors were in constant communication with him. There could be no doubt that Sir John's great ability and large experience would be of the utmost service to them in carrying the matter through. They had also some excellent expert engineering evidence, and the services of an experienced public accountant as well as of their own staff. The Company would be represented at the Court of Arbitration by three Counsel of great eminence—Sir Edward Clarke, K.C., Mr. Edward Boyle, K.C., and Mr. Boydell Houghton. He concluded by moving the adoption of the report.

The Deputy-Governor (Mr. Jackson Hunt) seconded the motion, which was carried unanimously; and resolutions were afterwards duly passed approving the payment of dividends for the half year ended March 31 last at the prescribed rates of 5 per cent. and 4½ per cent. on the preference stocks respectively, and of 5¾ per cent. on the ordinary stock of the Company, and re-electing the retiring Directors—Mr. W. H. Yatman, Mr. Jackson Hunt, and Mr. Charles H. R. Wollaston—and the retiring Auditor, Mr. John Drew.

A cordial vote of thanks to the Governor, the Deputy-Governor, and the Directors was afterwards passed; and a similar compliment to the Secretary and the other officers of the Company terminated the proceedings.

CARLISLE WATER SUPPLY.

The Geltsdale Scheme to be Carried Out.

The Geltsdale Water Committee of the Carlisle Corporation had a meeting a short time ago, at which a Sub-Committee (appointed at the preceding sitting) reported that, in accordance with the instructions of the Committee, they had had an interview with Mr. James Mansergh upon the subject of carrying out the provisions of the Carlisle Corporation (Water) Act, 1898, for the supply of water to the city from Geltsdale; and the Town Clerk submitted a letter he had received from Messrs. James Mansergh and Sons, setting forth the terms and conditions upon which they were prepared to accept the position of Engineers of the scheme. They stated therein that they should, of course, "take no cognizance whatever of the plans, sections, drawings, specifications, and bills of quantities prepared by the late Gas and Water Manager (Mr. Newton), but make our own independent surveys and design the works just as if nothing had previously been done, being

CARBURETTED WATER-GAS APPARATUS

Merrifield—Westcott—Pearson Patents.

The Economical Gas Apparatus Construction Co., Ld.

W. H. PEARSON, Chairman.
W. H. PEARSON, Junr., Deputy-Chairman.
J. T. WESTCOTT, Manager.
L. L. MERRIFIELD, M.Inst.M.E., Engineer.

London Offices: 19, ABINGDON STREET, WESTMINSTER, S.W.
American Offices: TORONTO. Telegraphic Address: "CARBURETED, LONDON."

CARBURETTED WATER-GAS ENGINEERS.

The above Company have erected since 1893, or are now erecting, their Universal Type of Carburetted Water-Gas Plant at the following Gas-Works:—

	Cub. Ft. Daily.		Cub. Ft. Daily.		Cub. Ft. Daily.
BLACKBURN	1,250,000	ST. CATHERINES (Remodelled)	250,000	ACCRINGTON	500,000
WINDSOR ST. WORKS, BIRMINGHAM	2,000,000	KINGSTON, PA.	125,000	TONBRIDGE	300,000
SALTLEY WORKS, BIRMINGHAM	2,000,000	PETERBOROUGH, ONT.	250,000	STRETFORD	500,000
COLCHESTER	300,000	WILKESBARRE, PA.	750,000	OLDBURY	300,000
BIRKENHEAD	2,250,000	ST. CATHERINES (Second Contract)	250,000	TODMORDEN	500,000
SWINDON (New Swindon Gas Co.)	120,000	BUFFALO, N.Y.	2,000,000	SALTLEY, BIRMINGHAM (Third Contract)	2,000,000
SALTLEY, BIRMINGHAM (Second Contract)	2,000,000	WINNIPEG, MAN.	500,000	YORK (Second Contract)	750,000
WINDSOR ST., BIRMINGHAM (Second Contract)	2,000,000	COLCHESTER (Second Contract)	300,000	ROCHESTER (Second Contract)	500,000
HALIFAX	1,000,000	YORK	750,000	NEWPORT (MON.)	250,000
TORONTO	250,000	ROCHESTER	500,000	TOKIO, JAPAN	1,000,000
OTTAWA	250,000	KINGSTON, ONT.	300,000	PERNAMBUCO (Brazil)	125,000
LINDSAY (Remodelled)	25,000	CRYSTAL PALACE DISTRICT	2,000,000	MALTON	150,000
MONTREAL	500,000	DULUTH, MINN.	300,000	DULUTH, MINN. (Second Contract)	300,000
TORONTO (Second Contract Remodelled)	2,000,000	CATERHAM	150,000	BROCKVILLE (ONT.)	250,000
BELLEVILLE	250,000	LEICESTER	2,000,000	SMETHWICK	500,000
OTTAWA (Second Contract)	250,000	ENSCHEDE (HOLLAND)	150,000	GRAVESEND	300,000
BRANTFORD (Remodelled)	200,000	BUENOS AYRES (RIVER PLATE CO.)	700,000	NEWPORT MON. (Second Contract)	250,000
		BURNLEY	1,500,000	TORONTO (Third Contract)	750,000
		KINGSTON-ON-THAMES	1,750,000	TORONTO (Fourth Contract)	1,000,000

Complete Gas-Works at NELSON, BRITISH COLUMBIA.

LEEDS, 1,800,000 C. Ft. LEICESTER (2nd Cont.), 1,000,000 C. Ft. NEWCASTLE-ON-TYNE, 1,800,000 C. Ft.
MONTREAL, ONT. (Second Contract) . . . . . 1,800,000 Cub. Ft.

bound only by the provisions of the Carlisle Corporation (Water) Act, 1898." The following were their terms: (1) For preliminary surveys, reports, interviews, &c., antecedent to the preparation of the actual working plans and drawings, the usual time-rates and out-of pocket expenses. (2) For work paid for on commission—Surveyors' work (taking out quantities, &c.), 1 per cent. on the amount of the accepted tenders; Engineers' work (preparing designs, plans, sections, and working drawings, specifications, making periodical inspections of the works in progress, examining monthly all statements of work done, made out by the Resident Engineer, and certifying for payments on account and final), 5 per cent. on the actual cost of all the works. The Resident Engineer, as well as his assistants and inspectors, to be appointed by Messrs. Mansergh and paid by the Corporation. The Committee considered the letter, and then passed the following resolution: "That the Council be recommended to accept the terms of Messrs. Mansergh and Sons; that the Town Clerk be instructed to prepare an agreement embodying the same; and that the common seal be affixed thereto."

At a subsequent meeting of the City Council, the above resolution was proposed by the Chairman of the Committee (Mr. Scott). He explained that Mr. Mansergh was not anxious to take the work, but at the interview he told the deputation that he was willing to help them, as he had seen that the city was in a difficulty. Mr. Mansergh's terms were before the Council. He had also sent them a letter explaining clearly his position and the conditions upon which he would undertake the responsibility of carrying out the scheme, as he wished them to understand his position. He informed them that sundry letters and communications had been sent to him, the tone of which was exceedingly unpleasant; and that if he had to be subjected to this sort of thing, he would rather have nothing to do with the scheme. He also said that the work was none of his seeking; but, as already mentioned, he expressed his willingness to help them. Now the Council knew the whole circumstances of the case. Mr. Mansergh put before them the terms on which he would undertake the work; and he (Mr. Scott) was pleased to say that they were the usual terms on which engineers of his standing did work of this kind. He thought they might congratulate themselves very much indeed in having at their disposal a gentleman of the eminence of Mr. Mansergh to carry out this scheme. Mr. Crowder seconded the motion. Mr. Collin moved, as an amendment—"That the settlement of the question be postponed till the Council had before them the plans of Messrs. Mansergh and Sons, with their estimate of the cost of the completed work." Mr. Laing seconded the amendment. Mr. White characterized Mr. Collin's position as perfectly ridiculous. Personally, he felt, as a member of the Council, that they were in safe hands, and that the firm they had consulted was the only one who could restore confidence, and bring order out of chaos in regard to the Geltsdale scheme. After some discussion, it was made plain to Mr. Collin that the plans would come before the Council, and that every step taken in this matter would be reported. Thereupon the amendment was withdrawn, and the Committee's resolution agreed to.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *June 27.*

Sulphate of Ammonia.

There has been a good demand for the time of year, but the desire on the part of makers to clear out their stocks before the end of the half year has had the effect of placing a larger supply on the market, and prices have slightly declined. The closing quotations are £12 17s. 6d. to £13 per ton f.o.b. Leith, and £12 16s. 3d. per ton f.o b. Liverpool. Hull is still the weak point, and the price there is nominally £12 12s. 6d. per ton. The forward position is attracting speculative attention, and London, Beckton terms, has been done at £12 10s. per ton, October-March delivery. The same price has been paid f.o.b. Leith, ordinary terms, for January-June 1904. The quotations f.o.b. Leith, ordinary terms, are £12 15s. per ton for July-September, and £12 12s. 6d. per ton for October-March.

Nitrate of Soda.

This is firm at 9s. 4½d. to 9s. 7½d. per cwt., according to quality, on spot. In Hamburg, where available supplies have become scarce, much higher prices are being paid for immediate delivery.

LONDON, *June 27.*

Tar Products.

There is nothing special to report, business generally being very quiet. The market for pitch remains dull; and there is not much demand for either prompt or forward delivery. The South Wales consumers appear to have filled up their requirements; while offers at very low prices are reported from the Continent. Probably, however, these are of a speculative nature. In benzol, there appears to be very little doing in 90 per cent., except for gas enriching, for which a special quality is required. In 50-90 per cent., small quantities have been placed at 7d. delivered to consumers' works, prompt. The market for crude carbolic remains unchanged. Business has been done in 60's at 1s. 6d. prompt; while a sale is reported at 1s. 6¼d. in London, July-October. Creosote is, if anything, a trifle better, there being rather more inquiry for early delivery. In anthracene, there is nothing fresh to report; but a small business is still doing in odd parcels for prompt delivery. The demand for crude naphthalene continues fairly good, especially for forward delivery, and more business is reported. The demand for the refined is fairly steady; but prices still rule very low. In solvent and toluol, the position remains unchanged; and the prices of both articles are purely nominal. As regards tar, there is nothing special to advise, no contracts of any importance having recently been placed; but the prices quoted are still abnormally high.

The average values during the week were: Tar, 23s. 6d. to 33s. Pitch, London, 56s. to 56s. 6d.; east coast, 53s. to 53s. 6d.; west coast, 52s. to 52s. 6d. Benzol, 90 per cent., 8¼d. to 8½d.; 50-90 per cent., 7d. Toluol, 6½d. to 7d. Crude naphtha, 3d.; solvent naphtha, 7½d.

THE

MAXIM PATENT CARBURETTOR

FOR ENRICHING GAS IN BULK.

PREVENTS NAPHTHALENE DEPOSITS.

OVER **100** MAXIM PATENT CARBURETTORS HAVE NOW BEEN FIXED.

Among the Companies and Towns supplied are The Gas Light and Coke Company, The South Metropolitan Gas Company, Birmingham, Leeds, Rochdale, Bristol, Sheffield, Southport, Alloa, Broughty Ferry, Dunfermline, and many other Works, both large and small, where they have been working in some instances for the past Seven Years.

MORE GAS & SALEABLE COKE PER TON of COAL CARBONIZED is PRODUCED; SAVING CAPITAL, LABOUR, FUEL, WEAR & TEAR, &c.

THE ENRICHMENT IS INSTANTANEOUS AND PERMANENT.

The Carburettor is inexpensive, easily fixed, and entirely supersedes the use of Cannel.

Dealers in Benzol, Carburine, and all other Naphthas and Oils suitable for the Enrichment or Production of Gas.

For Prices and full Particulars, apply to

THE GAS LIGHTING IMPROVEMENT COMPANY, LIMITED,

18, DEVONSHIRE STREET, BISHOPSGATE, LONDON, E.C.

to 8¾d.; heavy naphtha, 9d. Creosote, London, 1¼d. to 1⅜d.; North, 1⅛d. to 1¼d. Heavy oils, 2d. Carbolic acid, 60 per cent., 1s. 6d. Refined naphthalene, £5 to £8 10s.; salts, 21s. 6d. to 23s. Anthracene, "A" quality, 1⅜d. to 1⅝d.; "B" quality, 1d. nominal.

Sulphate of Ammonia.

The market continues steady; but there is not very much business doing. The principal demand is from London, where prices are well maintained. Beckton quote £12 17s. 6d. in any position, but have not yet been able to realize this price. Another large London Gas Company have declined this figure for June shipment, and are asking £13 for July. In Hull, there has been a little business doing at from £12 10s. to £12 12s. 6d., according to quality and period of shipment. In Leith, business appears to have been done at £12 17s. 6d.; but makers generally ask £13 for prompt shipment. The demand forward continues good; and prices vary from £12 5s. to £12 10s., according to period of delivery. In Liverpool, some small sales are reported at £12 13s. 9d.; but there is not much doing at this port. The general tone of the market is fairly good; but there is really not much business about.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

Litigation over patents is notoriously a branch of jurisprudence which is difficult to engineer. In all cases there are more people interested than the parties themselves. This is particularly true of the action which is in dependence in the Court of Session between the New Conveyor Company, Limited, and the Edinburgh and Leith Gas Commissioners, over the installation of inclined retorts which the latter have established at Granton. As will be seen from a report given in the "Legal Intelligence" of this issue of the "JOURNAL" (p. 973), the action took an interesting turn this week. The pursuers now propose to disclaim part of what they claim in their complete specification; and it was mentioned in the discussion before Lord Low on Tuesday that, although the record was formally closed in March, it has not yet been adjusted. In the unclosed record, the defenders give about twelve specific instances in which they say that the pursuers' patent was anticipated. The presumption is that it was on perusal of this list that the pursuers found out the difficulty they were in; and they suggest getting over it by withdrawing a part of their patent. This will entail an extensive revisal of the defenders' case, which will lead to a claim by the defenders for expenses to date. The first effect is the prolongation of the litigation, and the postponement of the time when it may be known what is and what is not protected by the pursuers' patent. This is to be regretted. As Lord Low points out, nothing can be done in the case this summer; and it will be next winter before progress can be made in Court. He decides nothing, but sends the pursuers to the Patent Office, to put themselves in trim for the conflict. When they come back, he will have an open mind upon the whole case. Meantime, the defenders are at liberty to go on using their plant. They are scarcely, if at all, prejudiced by the delay; for I take it that, should the case ultimately go against them, they will only at the most be required to pay royalties past due, in name of damages. The delay is to be regretted more because of those who may be contemplating the introduction of inclined retorts, and who are left in doubt as to what they ought to do—whether to follow the defenders' lead and defy the patent, or to acknowledge it and pay. In this respect, it is obvious that it is not in the interests of the pursuers to have the decision hung up indefinitely, because it may be taken for granted that, out of the possible number of gas-works owners who might introduce inclines, there will be a proportion who will hang back until a decision is given; and thus the litigation, while it lasts, is an undoubted disturbance of the pursuers' business.

The question of who is to supply a portion of Airdrie with gas is being moved in by the Coatbridge Gas Company, who, it turns out, have statutory powers for this purpose. A Model Lodging-House Company, who have premises at Coatdyke, have offered to take a supply of gas from the Coatbridge Company; and as the place is within the boundary of the burgh of Airdrie, notice has been given by the Coatbridge Gas Company to the effect that they may shortly have to exercise their powers with reference to the opening of streets in Airdrie. It is understood that the Council of the latter town are not opposed to the advent of the Coatbridge Company, because of the competition which they expect will ensue. If any opposition is offered, therefore, it will be by the Airdrie Gas Company—unless, which is hinted, it comes from within the Coatbridge Company itself, some of the members of which are said to be against the movement.

The report of the Auditor of the gas and electricity accounts of the Corporation of Perth has at length been received. It states that he has found the accounts to be accurately stated, sufficiently vouched, and instructed, and, subject to remarks, he has certified them. The sum of the asset of the old gas-works in Scott Street is now £94,696; a decrease having arisen during the past year from the amount received for plant sold, less the cost of taking down and removing the same. The establishment being now dismantled, the Auditor is of opinion that provision should be made for the writing down and gradual extinction of this very large sum as an asset of the gas establishment. The prices to be obtained for the site of the old works, in the shape of feu-duty or otherwise, would be applicable for the purpose; and it occurs to the Auditor to suggest that, under the Act of 1873, part of the balance at the credit of the contingency and depreciation of works fund might be more properly applied in reduction of this asset than in being used for the purchase of gas-stoves. It should be held in view, further, that in the future the contingency and depreciation of works fund account may have to bear a large part of the cost of renewals at the gas-works. The

RADIUM
costs £15,000
an ounce.
The
BEST COOKERS
will still
be made
by
RICHMOND'S

WARRINGTON.

Vide Press—

The metal Radium gives off heat, without any other external agency, a small quantity being sufficient to warm a large room and cook all daily meals.

STRATFORD.

works at Friarton are entered at £62,893. The increase in the year was £5230. The gas-stove account appears as an asset at £10,142.

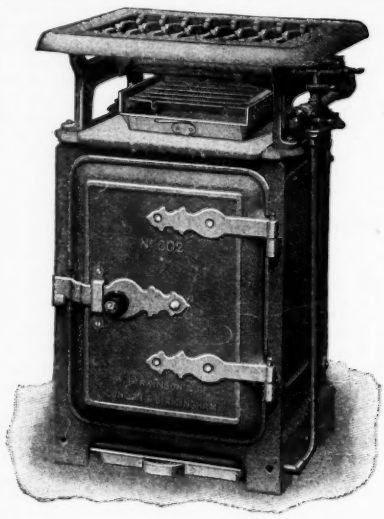
The Council held a special meeting on Thursday to consider the accounts and the Auditor's report. Mr. Cuthbert, the Convener of the Gas Committee, said that the past year had been very satisfactory. They had managed to pay all just and lawful accounts, and had closed the year with a balance of £561. The late Convener expected that they would sell 174 million cubic feet of gas, but they had only sold 164 millions. He might say there were two or three reasons for the falling off. The supply of gas to Bridge of Earn had not been so large as they anticipated. Last summer, too, was a rather cold and cheerless one, and this very much affected the demand for gas for heating and cooking. Then the discussions in the Town Council had shaken the confidence of the electors. He said so upon good authority. He had examined the question of the falling off, and found that it was mostly those who were using ordinary meters who had taken less gas, which showed that the decrease was among the class who were affected—he was sorry to say it—by the strong speaking in the Town Council as to the way the Gas Department had been carried on. The secondary products branch of their business had done exceedingly well. It was the sheet-anchor of their revenue. It was a very great pity, he considered that the Corporation did not establish a sinking fund for the redemption of annuities when they took over the gas undertaking. If they had done so, their debt would have been now in a different state. He would like to mention that the Gas Department had paid over £1400 as the cost of the Provisional Order for the Electricity Department. It was time, he thought, that this was paying its own way. The suggestions of the Auditor as to the writing down and gradual extinction of the value of the old gas-works would next year be carried out. As to the gas-stove account, he intended to move that the Gas Manager (Mr. W. B. M'Lusky) be asked to report upon the whole subject of the Stove Department, so as to enable them to carry into effect the Auditor's suggestions. He moved that the accounts be approved, and that the price of gas be reduced from 3s. 4d. to 3s. 2d. per 1000 cubic feet for lighting purposes, and from 3s. 4d. to 2s. 8d. for power purposes. As to the latter, he said they wished to encourage new industries in Perth, and they found that the Electricity Department were supplying power at a great deal less cost than the Gas Department. Mr. Macpherson moved that no change be made in the price of gas. He complained of want of details in the accounts, particularly as to the secondary products. He thought that the proposed change in the price of gas would result in loss. In the accounts they would find that the third largest item on the assets side was gas-stoves; and they would find that upon a capital outlay of over £10,000, the return was only £71. He asked if any private individual would be satisfied with that return. It meant little more than ½ per cent.—on the assumption that no allowance was made for depreciation. The Gas-Stove Department, he contended, had been a financial failure. The previous Convener prophesied that it would be a source of great profit; but the result had been only what those who looked into the matter at the time predicted—a record of failure. The Convener's motion was carried by 14 votes to 7. Almost the only opposition, it will be seen, was upon the gas-stove policy. I have given Mr. Macpherson's view upon that matter in order that we may be able to compare it with Mr. M'Lusky's report; and I hope no one will make up his mind on the subject until he has heard the other, and the authoritative, side of the question.

The Directors of the Hawick Gaslight Company, in their annual statement as to the affairs of the Company, say that the amount expended on repairs during the past year has been considerable, owing to its having been found necessary to re-sheet two of the gasholders. The mains have been extended at different parts of the town. The consumption of gas last year was greater than in any previous year. The Directors have recently gone over the works, and found them to be maintained in a state of efficiency. They recommend that the price of gas for next year be 2s. 11d. per 1000 cubic feet—being a reduction of 2½d. per 1000 cubic feet. It will be recollected that a year ago the Company reduced the price by as much as 5d. per 1000 cubic feet, so that the indications are all in favour of the Company enjoying a period of unbroken prosperity. It has to be borne in mind, too, in connection with the statement that the consumption of gas has been greater than in any previous year, that since last year the public lighting of the town has been changed from gas to electric light. This gives a significance to the statement which it does not of itself possess. The accounts which accompany the statement show that the quantity of gas sold during the year was 68,510,200 cubic feet, and that the revenue from gas was £10,982. There was derived from lime, tar, &c., sold, £1844, and from cooking-stoves £167; this transaction representing a profit of £25. Meter-rents amounted to £201, and cooking-stove rents to £38. The Company's policy is to sell meters as well as hire them. The coal carbonized during the year cost £6958. The total revenue was £13,250, and the profit on the year was £417. A balance of £1866 was brought forward from the previous year; and as it takes £1575 to pay a dividend of 10 per cent., it will be seen that there was ample funds to keep the return to the shareholders up to what it has been for I do not know how many years.

The annual meeting of the Kelso Gas Company was held on Wednesday, when the usual dividend of 10 per cent. was declared, and the price of gas was reduced from 4s. 2d. to 3s. 9d. per 1000 cubic feet to ordinary consumers—with the further reductions to 3s. 4d. to consumers of over 200,000 cubic feet a year, and to 3s. 1½d. to consumers of over 500,000 cubic feet—and from 5s. to 4s. 2d. per 1000 cubic feet to users of prepayment meters. It is interesting to know, in view of the extensive use of incandescent gas lighting in the town, both public and private, that the sale of gas went up by 4½ per cent., and that the profit on the year's working was the largest in the history of the Company. This was mainly owing to the return from residual products, which alone was £250 higher than in the preceding year. The Directors have unanimously voted a well-deserved increase of £20 in the salary of the Manager of the Company, Mr. P. R. Chalmers.

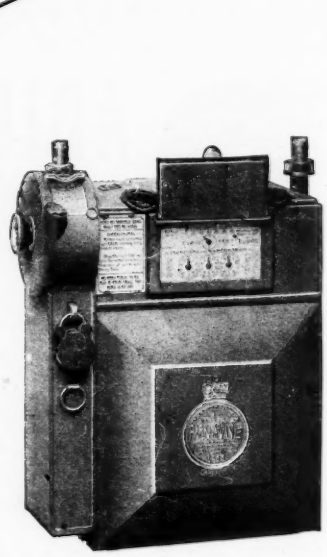
The places of the Alloa gas stokers—nine in number—who went on strike rather than accept 4s. 3d. per shift, when they demanded an advance of 6d., making their wages 4s. 6d., have been permanently filled

PARKINSON'S



FOR QUOTATIONS FOR

SLOT INSTALLATIONS



WRITE—

PARKINSON AND W. & B. COWAN LTD.,
(PARKINSON BRANCH)
LONDON AND BIRMINGHAM.

up, and the men who went out have been dismissed from the employment of the Corporation.

On Monday, the Gas Committee of the Dunfermline Corporation recommended that the price of gas for lighting and cooking be fixed at 2s. 9d. per 1000 cubic feet—a reduction of 3d.; and that the prepayment meter rate be fixed at 3s. 4d.—a reduction of 2d. Last year the price of gas was reduced to ordinary consumers by 6d. per 1000 cubic feet, and by 8d. to those who use prepayment meters. In the year preceding, a reduction of 5d. per 1000 cubic feet was made.

The Cambuslang Gas Company, Limited, held their annual meeting on Tuesday. The profit for the year was reported to have been £2562. But of this sum £1860 has been expended in payment of dividends at the rate of 8 per cent. on the old and new stocks; £500 has been allowed for depreciation; and £202 has been carried forward. The price of gas has been reduced from 3s. 4d. to 3s. 2d. per 1000 feet.

The Leven (Fife) Gas Company have paid a dividend at the rate of 5 per cent. for the past year after meeting the cost of considerable extensions to the works out of revenue.

COAL TRADE REPORTS.

Lancashire Coal Trade.

A slackening down in the demand is the general report throughout the coal trade of this district; and many of the pits have had to go on not more than two or three days, with four days per week representing the full average working time. Notwithstanding this restriction of output, supplies of all classes of fuel are ample to meet requirements; and in some of the better qualities of round coal, stocks have been accumulating. Coalowners, however, are apparently adopting the policy of restricting the output as near as possible to requirements, rather than put down in stock at the present cost of production or attempt to force sales at lower prices. House-fire qualities are, of course, just now in the smallest possible demand; but except for occasional spot lots, where holders of stocks under load have to make immediate clearances, there is no really material change in the general current rates. A good deal of surplus common round coal is on the market, which for prompt delivery can be bought at under current prices. In many cases large users are buying cheap lots from hand to mouth to keep them going and for the present—deferring the settlement of forward contracts. Common round coals for steam and forge purposes average about 8s. to 8s. 3d. per ton at the pit, with 8s. 6d. to 8s. 9d. quoted for some special qualities. For shipment, some very low prices are quoted to effect clearance sales; 8s. 9d. to 9s. being reported as a special cut price, with 9s. 3d. to 9s. 6d. about average quotations for steam coals delivered at the ports on the Mersey. With regard to gas coals, business is moving on much the same lines as previously reported; contracts, where they are settled, being generally on the basis of about 6d. below last year's rates. Quotations remain about 8s. 3d. to 8s. 9d. per ton for ordinary second Wigan four feet up to 9s. for special qualities, 9s. 3d. to 9s. 6d. for ordinary screened Wigan Arley, and 9s. 9d. to 10s. quoted for the best descriptions. The lessened time that collieries are now working is curtailing the output of slack; and engine fuel, although ample to meet requirements, is not quite so plentiful on the market. There is, however, still a good deal of surplus offering from outside districts at very low figures. As a result, prices are not more than maintained at late rates, common slack averaging 4s. 3d. to 4s. 6d. per ton, medium sorts 5s. and 5s. 3d. up to 5s. 9d., best slacks 6s. 6d. to 6s. 9d., with special qualities quoted at 7s.

Northern Coal Trade.

The coal trade of the North-east has been influenced by the local holidays; and with a lessened production of coal, prices have shown some steadiness. There is a full demand now that the production has about returned to its normal extent. In the steam coal trade, there is a steady inquiry for best Northumbrian steams, the price of which is from 10s. 7½d. to 10s. 9d. per ton f.o.b., second class steams are quiet at 9s., and steam smalls are steady at 5s. 9d. per ton, with a fair demand. In gas coal, the export demand is full for the season, the shipments to the Mediterranean being very heavy at the present. The price for Durham gas coals varies from 8s. 6d. to 9s. 3d. per ton f.o.b., according to quality. One or two comparatively small contracts have been fixed, at slight reductions on the price that ruled for the previous year, and there are others that are likely to be decided soon at similar reductions. The coke trade is firm, and gas coke is necessarily steadied by the very small production at present. The quotation is now about 12s. 6d. to 13s. 3d. per ton f.o.b. for good gas coke. The local sales are smaller; but the price is unaltered.

Scotch Coal Trade.

Trade remains dull, little new business being taken up. Last week Sheriff Jameson, as Oversman, in the matter of conciliation between masters and men, decided that the evidence entitled the masters to a reduction of 6¾ per cent.—6d. a day—which they asked in the wages of the miners. This reduces the wages to the minimum of 5s. 6d. per day. If wages regulate prices, then they should begin to be easier. There is no change as yet. The quotations are: Main, 8s. to 8s. 3d. per ton f.o.b. Glasgow, ell 8s. 6d. to 10s., and splint 9s. 3d. to 9s. 6d. The shipments for the week amounted to 247,821 tons—an increase of 34,760 tons upon the previous week, and of 15,532 tons upon the corresponding week of last year. For the year to date, the total shipments have been 4,875,756 tons—an increase of 181,827 tons upon the same period of last year.

Examinations in Gas Manufacture.—We learn there was an error in the pass-list supplied to us of the last City and Guilds of London Institute examinations in "Gas Manufacture" (*ante*, p. 907). In the Honours Grade, the name J. H. W. White should read J. H. W. Wills.

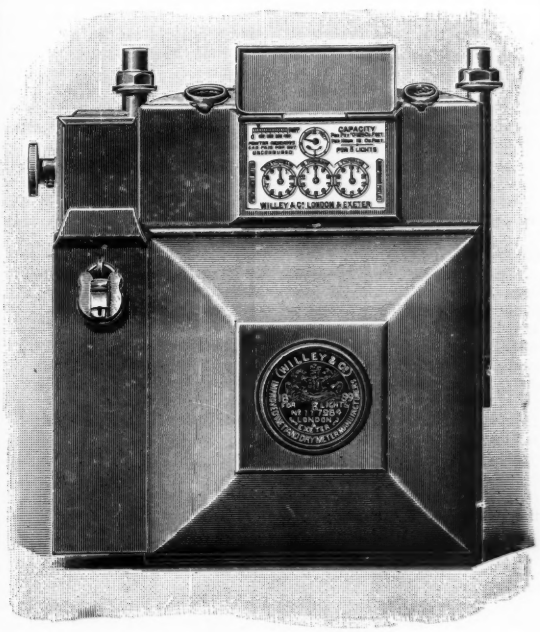
THREE POINTS

of advantage from the many found in our Slot Meters are:

1st.—They are Fraud Proof, and Cannot be tampered with through the Slot.

2nd.—The Slot is closed when the maximum number of Coins have been inserted.

3rd.—Our Price Changing System is the Simplest, Quickest, and most Accurate yet devised.



ALL PARTS INTERCHANGEABLE.

Tens of Thousands in use, and adopted exclusively by many Gas Companies.

WILLEY & CO., LONDON AND EXETER.

A Satisfactory Report at Selby.—The annual report and balance-sheet of the gas-works which were presented by Mr. Ullathorne at the last monthly meeting of the Selby Urban District Council, showed that the total receipts during the past year amounted to £7187; and after meeting the working expenses, there was left a balance of £2944 to be used for the payment of interest on the loan. The report, which was considered a highly satisfactory one, was adopted.

Leeds Gas Supply.—At a meeting of the Gas Committee of the Leeds Corporation held on Wednesday, under the presidency of Alderman Lowden (the Chairman), the statement of accounts with reference to the working of the gas undertaking for the year ended the 25th of March last was submitted. It showed a surplus of £35,278. After setting aside £24,260 for the redemption fund, there remained a net profit of £11,018. This was considered very satisfactory. It was reported that the output of gas during the year had averaged 10,671 cubic feet per ton of coal carbonized—these figures forming a record in the history of the gas-works.

Reductions in Price.—Notice has been issued by Mr. W. H. Cochran, the Secretary of the Formby Gas Company, Limited, that from the 1st of July the price of gas used for illuminating purposes will be 4s. per 1000 cubic feet; and for cooking, heating, and motive power, 3s. 4d. In the case of slot-meters, 20 cubic feet of gas to be used for illuminating purposes will be supplied for 1d., and 22 cubic feet for cooking, &c. The price now charged is 4s. 6d. for lighting and 3s. 10d. for cooking; so that there will be a reduction of 6d. per 1000 cubic feet in each case. As from to-morrow, the price of Newhaven gas for private consumption will be reduced by 3d. per 1000 feet.

Bruce Peebles and Co., Limited.—A Company has been formed under this title, with a capital of £200,000, divided into 20,000 6 per cent. cumulative preference shares and 20,000 ordinary shares of £5 each, to acquire the business of D. Bruce Peebles and Co., Engineers, of Edinburgh, with offices in London, Cardiff, Manchester, and Newcastle-on-Tyne, and agencies in other towns. For each year in respect of which more than 6 per cent. is paid on the ordinary shares, the preference shares will receive the same rate of dividend, with a maximum of 7½ per cent. The present issue consists of the whole of the preference and 3000 ordinary shares. The purchase price has been fixed at £115,000, payable £85,000 in ordinary shares and £30,000 in cash.

Metropolitan Water Board.—At the meeting of the Board last Friday week, the Finance Committee submitted a report on the draft regulation of the Local Government Board as to the stock to be issued. After considerable discussion, the Board decided to suggest certain alterations to the Local Government Board. Among the principal changes were that the period of redemption should be 25 and not 30 years, as proposed by the Board, and that the certificates to bearer should be issued for £10 or a multiple thereof. It was also resolved to ask the London County Council to permit Mr. Haward, the Comptroller, to give his advice and assistance, and attend as a witness in connection with the arbitration. Under the regulations of the Council, Mr. Haward cannot receive payment for his services.

Irish Gas-Works and Meter Stamping.—The following resolution with regard to the stamping of gas-meters was proposed by Mr. M'Innes at last week's meeting of the Belfast Gas and Electric Committee—"That, since there is at present no meter-stamping establishment in Ireland, we request the Board of Trade to sanction such an establishment in Belfast, and are confident there are several workmen in our employment, any of whom we could strongly recommend as efficient stampers." Mr. M'Innes stated that during the past five years they had paid £675 for stamping, and £108 for the carriage of meters between Belfast and Glasgow. Mr. Forsythe seconded the motion. The Town Clerk explained the law on the question, and pointed out that the stampers would have to be appointed by the City Magistrates in conjunction with the Grand Jury of the county of the city. It was resolved that the Town Clerk and the Gas Engineer (Mr. J. Stelfox) should draw up a report on the subject, to be submitted at a later date.

Serious Gas Explosion at Barnard Castle.—A serious explosion of gas occurred last Tuesday night at Barnard Castle, by which the Town Surveyor (Mr. G. G. Donkin) and two labourers were unfortunately badly injured. The accident took place in the higher part of the town, at the exact spot where there was a short time ago a similar, though less serious, explosion. It appears that Mr. Donkin and the two men, with a lantern, were endeavouring to trace a supposed leakage of water, the reservoir having rapidly run down. An escape of gas had been long known to exist in the locality; and it was attributed to an old and defective main. At any rate, the men entered a manhole in the course of their investigations; and it is supposed that the light they carried ignited a large volume of coal gas, with the result that a terrific explosion took place. Mr. Donkin was much injured about the head and face, his features being scarcely recognizable; and both the other men were also much burnt, it being feared that one of them will lose his eyesight.

Completion of the Midhope Reservoir at Barnsley.—The new reservoir which has been under construction by the Barnsley Corporation at Midhope for the past five or six years, and which has cost nearly double as much as was originally contemplated, has at last been completed; and the inauguration of the scheme took place on Thursday, amid general rejoicing. This reservoir will put the borough of Barnsley and the surrounding townships in possession of a supply of pure water sufficient for, at any rate, the next thirty years, and will more than double the existing supply. It has been formed by means of a dam 120 feet high and 1000 feet long; and it will hold 450 million gallons. The water, which extends over 56 acres, is already 69 feet deep, and will ultimately be another 20 feet. Mr. Charles Hawksley, the Engineer of the scheme, requested the Mayor to open the valve, and at the same time presented his Worship with a handsome goblet as a memento of the occasion. The Mayor, in reply, paid a high tribute to the work done by Mr. Thompson, the Superintendent of the Works, and Mr. J. H. Taylor, the Borough Engineer. The opening ceremony was followed in the evening by a banquet.

"THE MAIN"

NEW SERIES

SLOT COOKERS

In 4 Sizes,

WITH FIXED OR LOOSE BURNERS

AS DESIRED.

The Best on the Market.

R. & A. MAIN, LTD.,

LONDON, GLASGOW, BIRMINGHAM,

MANCHESTER, BRISTOL.

Factories: LONDON AND FALKIRK.

Profits at Oldham.—At the last fortnightly meeting of the Oldham Gas Committee, the General Manager (Mr. Arthur Andrew) reported that the net profit on the past year's working of the Gas Department was £18,761, which was increased by interest on the redemption fund to £19,358. Out of this sum, the borough fund was entitled to £9049; leaving a surplus of £10,309. Last year there was a debit balance of £1970, so that on the present occasion there is a credit balance of £8339. It is stated that residuals have been the principal contributor to this improved condition of affairs.

Higham Ferrers and Rushden Water Board.—Mr. E. T. Squarey, the Arbitrator appointed to adjudicate upon the claims made by Major-General Southby, of Ecton, and Mrs. H. M. Stockdale, for compensation for land compulsorily taken from them under the Act of Parliament constituting the Higham Ferrers and Rushden Joint Water Board, has given his decision in an award which has just reached the parties. Major-General Sotheby's claim for land disturbances amounted to £10,500; the Arbitrator has awarded him £5383 15s. Mrs. Stockdale's was for £7700, and the amount awarded is £4648 7s. 6d.

Loans of Local Authorities.—At the opening sitting, on Monday last week, of the Joint Committee of Lords and Commons on Municipal Trading. Sir S. B. Provis, K.C.B., the Permanent Secretary of the Local Government Board, gave some figures in respect of the loans sanctioned by them to local authorities in the three years 1900-2 They included £1,641,000 for gas-works, £2,420,000 for water-works, and £10,226,000 for electric lighting. He had also prepared figures showing the outstanding debt of local authorities for the years ended March 31, 1885, 1898, and 1901—the last year for which the returns were available. These figures included the following: Gas-works—1885, £13,768,000; 1898, £18,292,000; 1901, £20,781,000. Water-works—1885, £30,326,000; 1898, £47,867,000; 1901, £56,255,000. Electric lighting—1885, no particulars available; 1898, £3,674,000; 1901, £11,066,000. The total amount of outstanding loans for all purposes was: 1885, £173,207,000; 1898, £262,017,000; and 1901, £316,704,000, or an increase of 82 per cent. since 1885.

A Much-Needed Filtration Scheme.—"Standing still is sometimes an expensive luxury," says the "Engineering Record," "as the city of Pittsburg is beginning to understand, when the project for filtering its water supply is considered." Several years ago, the citizens voted to spend $2,500,000 for this purpose, plans for the work were prepared by eminent specialists, and bids were solicited. Since then nothing has been done. The city is paying 3½ per cent. interest on the bonds it issued, which were to the amount mentioned; and it has to its credit from the proceeds of the bonds the sum of $2,218,347 on which it receives 2 per cent. interest. It is thus losing a considerable sum in the difference between these two interest charges, as well as large sums indirectly through the 6·31 per cent. typhoid fever death-rate, not to mention the loss due to the sickness of people who recover from this disease. Not only is the general death-rate of the city high—19·77 per 1000—but the percentage of the deaths due to typhoid is altogether too great; for in Philadelphia it is only 1·84, in Baltimore 1·36, in Boston 1·26, and in New York 1·03.

The Rainfall in May and the London Water Supply.—In their report for the past month, to the Official Water Examiner for the Metropolis (Mr. Charles Perrin, M.Inst.C.E.), Sir William Crookes, and Professor Dewar say: "The rainfall at Oxford during the month of May was exceptionally heavy; the amount recorded being 4·38 inches. The average rainfall for May is 1·75 inches; thus we have had an excess of 2·63 inches, and this, added to the previous one of 1·72 inches, makes a total excess for the year of 4·35 inches, or 49·9 per cent. on the thirty years' average. Of the 281 daily samples taken from the filter-wells of the Metropolitan Water Companies, ten, or 3·5 per cent., were sterile. There were seven samples, or 2·4 per cent., containing more than 100 microbes; and of these, only two samples contained more than 150 microbes per cubic centimetre. The seven excess samples contained an average of 124 microbes. In April, five excess samples contained an average of 122. From this it is satisfactory to note that, in spite of the sudden and exceptional rainfall during the month of May, the bacteriological quality of the London water remains substantially as good as during the previous month; proving that adequate care has been expended and a high efficiency attained in the results of the filtration."

Sale of Stock of the Croydon Gas Company.—On Thursday, at the Greyhound Hotel, Croydon, Messrs. Hooker and Webb offered for sale by public auction several lots of stock of the Croydon Gas Company. Five lots of £100 Consolidated "B" ordinary stock, carrying a dividend of 11 per cent., free of income-tax, fetched £245 per £100; while some lots of £50 of the same stock were sold at £243, £244, and £244 10s. per £100 of stock.

A letter has been received by the Halifax Corporation from the Local Government Board sanctioning their application to borrow £51,604 for gas-works purposes.

Messrs. F. C. Sugden and Co., of Leeds, have had orders placed with them for regenerator settings and ironwork by the Blackrod and the Kirkburton Gas Companies.

Messrs. Ritchie and Co., of London, have been entrusted with the illumination of the Grand Opera House, Covent Garden, on the occasion of the visit of President Loubet to the gala performance.

The Newmarket Gas Company have placed an order with Messrs. R. Dempster and Sons, Limited, of Elland, for a complete installation of four settings of eight retorts each, on Waddell's patent regenerator system.

Messrs. Joseph Taylor and Co., of Bolton, have received an order from the Holborn Union, for their Bond's Road Gas-Works, Mitcham, for a plate lead saturator, with double detachable ammonia pipes and detachable acid pipe, and also for a sulphate drainer, acid tank, pipes, &c.

The Dean and Chapter of Westminster Abbey have entered into an agreement with the Gaslight and Coke Company for the lighting of the Close by incandescent gas-lamps at the public lighting rates. The agreement dates from the 24th inst.

The Littlehampton authorities are about to abandon the use of sea water for watering the roads. It is found that the salt causes rust, destroys cycle tyres, injures tradesmen's goods, and rots the roads. Hythe, however, has just decided to use sea water to husband the fresh water supply.

The consumption of water from the Boston Metropolitan Water-Works during the year 1902 was 123 gallons per inhabitant per day. The total quantity of water used or wasted to prevent freezing during the colder months was equivalent to a daily average consumption of 4½ million gallons for the year.

At the meeting of the London County Council last Tuesday, a contract for the supply of 6283 tons of gas coke was placed with Messrs. George Howlett and Sons. The price is from 19s. to 21s. per ton. Of the total, 2200 tons will go to the Fire Brigade Stations, 800 tons will be distributed among the parks, a portion will go to the gas-meter testing-offices, and 1000 tons are estimated to be used for miscellaneous work within a radius of three miles from Vauxhall.

At the annual general meeting of Messrs. J. & H. Gwynne, Limited, last Friday, the Chairman (Mr. John Gwynne, M.Inst.C.E.) announced that the Board had recently entered into an arrangement for the purchase of the business of Messrs. Gwynne and Co., of Brook Street Works, Holborn, and the transfer of the plant to the Company's works at Hammersmith. The services of Mr. Neville Gwynne, the Chairman's nephew, who has latterly managed the Brook Street establishment, have been secured by the amalgamation of the two concerns.

Waste of water has reached so serious a stage in Chicago that the Chief of Police has issued orders for the arrest of all persons found violating the ordinance which restricts lawn sprinkling to a couple of hours early in the morning and four in the evening. The loss of pressure in apartment houses in some parts of the city is causing much inconvenience. The City Engineer is blamed for much of the trouble, and he admits that the situation is serious. In his opinion, the remedy to be applied first is to check the waste. This being so, he should set about doing it.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

AGENTS FOR FIRE CEMENT. No. 4051.
ASSISTANT-ENGINEER. Wigan Gas Department. July 14.
FITTER. Ware (Herts) Gas-Works.
MAIN AND SERVICE LAYER, &c. Wilmslow Gas-Works.
OUTDOOR SUPERINTENDENT. Canterbury Gas and Water Company.
SALES AND SHOW-ROOMS CLERK. No. 4055.

Situation Wanted.

DRAUGHTSMAN OR REPRESENTATIVE, &c. No. 4046.

Plant, &c., for Sale.

PURIFIERS, &c. Leighton Buzzard Gas-Works.

Sales of Stocks and Shares.

CROYDON GAS COMPANY. July 9.
HARWICH GAS COMPANY. July 6.
HIGH WYCOMBE GASLIGHT COMPANY. July 17.
RUGBY GAS COMPANY. July 3.
SOUTH ESSEX WATER COMPANY. July 14.
SUTTON WATER COMPANY. July 6.
SWANSEA GAS COMPANY. July 7.
TENDRING HUNDRED WATER COMPANY. July 6.

TENDERS FOR

Coal and Cannel.

COALVILLE GAS DEPARTMENT. Tenders by July 11.
DALTON-IN-FURNESS GAS DEPARTMENT. Tenders by July 15.
DEWSBURY GAS DEPARTMENT. Tenders by July 8.
DROITWICH GAS DEPARTMENT. Tenders by July 7.
HAVERFORDWEST GAS DEPARTMENT. Tenders by July 24.
HEXHAM GAS COMPANY. Tenders by July 6.
ILKESTON GAS DEPARTMENT. Tenders by July 7.
KENT WATER COMPANY. Tenders by July 4.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by July 6.
RHYL GAS DEPARTMENT. Tenders by July 14.
SAFFRON WALDEN UNION. Tenders by July 4.
WINSFORD GAS DEPARTMENT. Tenders by July 14.
WORKINGTON GAS DEPARTMENT. Tenders by July 13.

Condenser Box, &c.

SEDGLEY GAS DEPARTMENT. Tenders by July 8.

Exhauster and Engine, &c.

SEDGLEY GAS DEPARTMENT. Tenders by July 8.

Lime.

HEYWOOD GAS DEPARTMENT. Tenders by July 14.

Meters.

DEWSBURY GAS DEPARTMENT. Tenders by July 8.

Oxide (Spent).

COATBRIDGE GAS COMPANY.

Pipes and Fittings, &c.

DEWSBURY CORPORATION. Tenders by July 8.
HEYWOOD GAS DEPARTMENT. Tenders by July 14.
SPALDING GAS DEPARTMENT.

Retorts Settings.

HINDLEY GAS DEPARTMENT. Tenders by July 13.

Sulphuric Acid.

DEWSBURY GAS DEPARTMENT. Tenders by July
HEYWOOD GAS DEPARTMENT. Tenders by July 14

Tar and Ammoniacal Liquor.

BRIERLY HILL GAS COMPANY. Tenders by July 16.
DALTON-IN-FURNESS GAS DEPARTMENT. Tenders by July 15.
LOUGHBOROUGH GAS DEPARTMENT. Tenders by July 6.
HANWELL ASYLUM. Tenders by July 4.

We have received the first three numbers of a weekly publication that has been started in Brussels, under the title of "Le Vulcain," to chronicle matters connected with what are called the "fire industries." It will also deal with gas and lighting, electricity, coke-ovens, chemical products, &c. The price is 20c.

Of the 79,742 houses in Paris, 47,716 may be regarded, says "Le Journal," as very good, or good from a hygienic standpoint, and 32,026 as indifferent or defective. Out of the above total, 59,959 are provided with spring water, and 11,050 with both spring and river water; while 23,252 have modern sanitary arrangements. Lighting is effected by electricity in 4651, by gas in 57,740, and by oil or petroleum in 17,351.

The prevention of contaminated water being furnished for domestic consumption is the subject of a recently approved law in New Hampshire. It provides as follows: "Whenever the State Board of Health, upon investigation, become satisfied that a well, spring, or other supply of water, used for domestic purposes, has become polluted so as to endanger the public health, they are authorized to prohibit the person or corporation owning or controlling the supply from furnishing such water for domestic purposes, until they become satisfied that the supply has been purified and made fit for domestic use. Any persons or corporation officials or agents violating the order of the Board shall be punished by a fine of not less than $100 and not exceeding $1000 for each and every day they continue to furnish water for domestic purposes after the order of the Board has been served upon them."

Messrs. W. Sugg and Co., Limited, have been successful in obtaining the contract to light St. Anne's-on-the-Sea pier with their patent system of high-pressure gas incandescent lighting. We understand that this will be the first pier to be lighted with high-pressure gas. The pier will be illuminated by Sugg's patent 1000-candle "Whitehall" lamps, fixed down the centre; and around the pierhead 600-candle "Whitehall" lamps will be used. The pavilion will be lighted with six Sugg's patent 1000-candle ornamental "Swindon" lamps, and one Sugg's patent 600-candle sun burner. There will be a total of 23 lamps of 1000-candle power, 14 of 600-candle power, and 3 of 300-candle power; while the shops and offices will be lighted with high-pressure burners fixed on brackets and pendants. To raise the gas to the required pressure of 10 inches, a Sugg's Patent gas-engine pressure increaser will be used of 1¼ brake horse power.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or Stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under 3s.; each additional Line, 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

United Kingdom: One Year, 21s.; Half-Year, 10s. 6d.; Quarter, 6s. 6d.
Payable in Advance. If credit is taken, the charge is 25s. a year

Abroad (in the Postal Union): £1 5s. 6d., payable in Advance.

All Communications, Remittances, &c., to be addressed to
WALTER KING, 11, BOLT COURT, FLEET STREET, LONDON, E.C.
Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

OXIDE OF IRON.

O'NEILL'S OXIDE has a larger annual sale than all other Oxides combined.

SPENT OXIDE purchased in any district.

GAS PURIFICATION & CHEMICAL CO., LD.,

JOHN WM. O'NEILL, Managing Director,

PALMERSTON HOUSE, LONDON, E.C.

WINKELMANN'S
"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for GAS-WORKS.
ANDREW STEPHENSON, 182, Palmerston House, Old Broad Street, London, E.C. "Volcanism, London."

BROTHERTON & CO., LIMITED.
Offices: Commercial Buildings, LEEDS.
Correspondence invited.

SULPHATE OF AMMONIA
SATURATORS and LEAD WORK for Sulphate of Ammonia Plants.
For REPAIRS or ALTERATIONS, ring up "0848 BOLTON," or Telegraph "SATURATORS, BOLTON."
Largest Practice and most Up-to-Date Works in Britain.
JOSEPH TAYLOR AND CO., CENTRAL PLUMBING WORKS, BOLTON.

GAS TAR wanted.
BROTHERTON AND CO., LTD., Tar Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

IT is worth your while to buy direct.
THE RELIANCE LUBRICATING OIL COMPANY 19 and 20, Water Lane, Great Tower Street, London, E.C., handle all kinds of Lubricating Oils, for Engines, Cylinders, Dynamos, Spindles, &c., Burning Oils, Solar Distillates, Carburetting Oils, and Spirits for Gas Making; Motor Oils, Fuel Oils, Animal, Fish, and Vegetable Oils, &c., for all purposes. Write for our "Trade Mark" Inkstand, sent free to customers. Non-customers, 2s. 6d. each. RELIANCE LUBRICATING OIL COMPANY, London, Glasgow, Newcastle-on-Tyne, &c. Established 1858. Telegraphic Address: "Subastral," London; A.B.C. Code used. Telephone No.: Avenue 5891.

SULPHURIC ACID for Sale.
BROTHERTON AND CO., LTD., Chemical Manufacturers. Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

PENNY-IN-THE-SLOT WORK.
H. GREENE & SONS, Ltd., are prepared to give QUOTATIONS to Gas Companies or Corporations for FITTING UP COMPLETE and CARRYING OUT the WORK in its entirety, either in Iron or Compo.
SURREY ENGINEERING WORKS, BLACKFRIARS ROAD, LONDON, S.E.
Telephone: 1693 HOP. Telegrams: "LUMINOSITY."

AMMONIACAL LIQUOR wanted.
BROTHERTON AND CO., LTD., Ammonia Distillers.
Works: BIRMINGHAM, LEEDS, and WAKEFIELD.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E.
First-Class Award, Melbourne Exhibition, 1889, for WET AND DRY GAS-METERS, STATION METERS, AND GOVERNORS, PRESSURE-GAUGES, STREET LAMPS AND PILLARS, &c.
Telegraphic Addresses:
"Braddock, Oldham." "Metrique, London."

DUTCH OXIDE OF IRON.

THE First Dutch Bog Ore Co., Ltd.
(Eerste Hollandsche Yzererts Maaty), ROTTERDAM.
General Manager for England and Wales—
CHARLES E. FRY, LEAMINGTON; and at Tower Chambers, Brown Street, MANCHESTER.
London Managers—
E. PADFIELD & CO., 96-98, Leadenhall Street, LONDON, E.C.
General Manager (for Scotland)—
J. B. MACDERMOTT, 11, Bothwell St., GLASGOW.

JOHN RILEY & SONS, Chemical Manufacturers, Hapton, near Accrington, are MAKERS of Special SULPHURIC ACID, for Sulphate of Ammonia Making. Highest percentage of Sulphate of Ammonia obtained from the use of this Vitriol, which has now been used for upwards of 50 Years. References given to Gas Companies.

SPECIAL PAINT FOR GAS-WORKS.
JOHN E. WILLIAMS AND CO.,
VICTORIA PAINT WORKS,
MANCHESTER.
Telegrams: "ENAMEL." National Telephone 1759.

PATENTS AND TRADE MARKS
PUBLICATIONS. "MERCHANDISE MARKS ACT, and Decisions thereunder," 1s.; "TRADE SECRETS v. PATENTS," 6d.; "DOCTRINE of EQUIVALENTS, Mechanical and Chemical," 6d.; "SUBJECT-MATTER of PATENTS," 6d.
MEWBURN, ELLIS, & PRYOR, Chartered Patent Agents, 70 and 72, Chancery Lane, London, W.C. Telegrams: "Patent London." Telephone: No. 243 Holborn.

HYDRATED OXIDE OF IRON.
PREPARED from Pure Iron.
Twice as Rich as Bog Ore.
Gives no Back Pressure.
The Cheapest in the Market.
Can be Lent on Hire.
Can be Exchanged for Spent Oxide.
READ HOLLIDAY AND SONS, LTD., HUDDERSFIELD.

AMMONIACAL Liquor wanted by JOHN RILEY & SONS, Hapton, near ACCRINGTON.

STREET AND SHOP LAMPS AND LANTERNS.
MARK DUFFIELD & SONS (Established 200 Years), Makers of Street and Shop Lamps to own Pattern and Design. Any description of Lamp made. Inquiries invited.
London Manager: EDWARD PADFIELD, West India House, 96 & 98, LEADENHALL STREET, E.C.
Telegraphic Address: "EUPATHY, LONDON."

COAL GAS TAR wanted.
Gas Managers in Gloucester, Somerset, Worcester, Devon, Wilts, Hereford, Monmouth, and Glamorgan PLEASE NOTE. BEST PRICE offered, either on Fixed or Sliding-Scale Basis.
State Quantity to offer for Prompt and Forward Delivery.
The SHARPNESS CHEMICAL COMPANY, Tar Distillers, Sharpness Docks, GLOS.

OXIDE OF IRON.
(NATURAL.)
BALE & CHURCH will be pleased to send Samples and Quotations, and make Offers for SPENT OXIDE.
BALE'S FIRE CEMENT, PAINT, AND GAS COAL,
5, CROOKED LANE, LONDON, E.C.

TO GAS AND WATER OFFICIALS.
COURT ROYAL CYCLES are largely supplied to Public Officials. Specially REDUCED PRICES to GAS MANAGERS and ASSISTANTS where unrepresented. See and test one of these sterling high-grade Manufactures before deciding upon any new purchase. Large Catalogue, Books of Testimonials, and Special Prices sent, on application, from the Makers
LLOYD COURTS AND CO., COVENTRY.

SULPHATE of Ammonia Plant Repairs, &c., done on short notice with new patent Lead Burning Apparatus. No Men required for Blowing, Workmanship guaranteed. Distance no object.
Address DAVIES, 78, EARL'S COURT ROAD, W.

WANTED, a position in or near London as DRAUGHTSMAN or REPRESENTATIVE. Twelve Years' practical Experience with leading Gas Engineers. Well up in all branches of the Gas Industry.
Address No. 4046, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, District Agents to undertake the Sale of Fire Cement and Paint.
Apply, by letter, to No. 4051, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

WANTED, a good, steady, reliable handy FITTER, used to Incandescent Lighting, Meter and Stove Fixing, and Slot Work. Also Main and Service Laying and Rough Smithing. Must be quick and Willing, and able to read Meters.
Apply, stating Wages required, whether Married or Single, to the MANAGER, Gas-Works, Ware, HERTS.

CANTERBURY GAS AND WATER COMPANY.
WANTED, a competent Man as Out Door SUPERINTENDENT to work under the Instructions of the Engineer. Experience in Main and Service Laying and Incandescent Lighting necessary.
Applications, with References, stating Wages required, to be sent to the undersigned,
JAMES BURCH,
General Manager and Secretary
June 22, 1903.

WANTED, a steady, reliable Man, as MAIN and SERVICE LAYER, GAS-FITTER, &c. One who can do Smith Work preferred. Wages 27s. per week.
Apply to the MANAGER, Gas-Works, Wilmslow, MANCHESTER.

WANTED, by a Gas Company in the South of England, a Young Man with a knowledge of Incandescent Lighting, Inverted Burners, Gas Fires and Stoves, to TAKE CHARGE of the Show-Rooms and act as SALES CLERK.
Commencing Salary, 30s. per week.
Applications, in Candidate's handwriting, stating Age, previous Experience, and how at present occupied, accompanied by *copies* of two recent Testimonials, to be addressed to No. 4055, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C., not later than Saturday, July 4.

COUNTY BOROUGH OF WIGAN.

AN Assistant Gas-Engineer Wanted for the above. Salary, £150 per annum.
Candidates must possess the following qualifications: Practical experience in Mechanical Engineering, preparation of Drawing's for Mechanical and Building Structures, Chemical Analysis, Carbonization, with Generative and Regenerative Retort-Settings, Manufacture of Sulphate of Ammonia, and use of the Bar Photometer.
Applications, sealed and endorsed "Assistant Engineer," to be addressed to Harold Jevons, Esq., Town Clerk, Town Hall, Wigan, on or before July 14 next ensuing.
Canvassing not permissible.
Any further Particulars may be obtained by communicating, in writing, with the undersigned.
J. TIMMINS, M.Inst.C.E.
Engineer and Manager.
Wigan, June 25, 1903.

WANTED, Gas Carbon, in Four Ton Lots or more, f.o.r. Must be Clean and Hard Lumps.
Address No. 4044, care of Mr. King, 11, Bolt Court, FLEET STREET, E.C.

FOR SALE—A quantity of Spent Oxide (about 200 Tons).
Samples on application to the MANAGER, COATBRIDGE GAS COMPANY.

TO BE SOLD—Purifiers, Two or Four, 10 feet square by 4 ft. 6 in. deep, planed Joints, Connections, and Overhead Girders.
Write J. WRIGHT, 181, QUEEN VICTORIA STREET, E.C.

FOR SALE, Cheap—Two Dowson Gas- GENERATOR PLANTS, equal to 20,000 cubic feet per hour, complete.
Particulars on application, to J. FIRTH BLAKELEY & Co., Gas Engineers, DEWSBURY.

FOR SALE—Four 12 feet square Puri- fiers, with 12-inch Connections, Centre-Valve, and Grids Complete, put on rail for £200.
For further Particulars, apply to C. F. RUGGLES, Gas-Works, LEIGHTON BUZZARD.

GAS PLANT for Sale—I can always offer NEW and SECOND-HAND GAS APPARATUS, including Retorts and Fittings, Condensers, Exhausters, Scrubbers, Washers, Purifiers, Gasholders, Tanks, Valves, Connections, &c. Also a few COMPLETE WORKS. Compare Prices and Particulars before ordering elsewhere.
J. F. BLAKELEY, Gas Engineer, Thornhill, DEWSBURY.

CORPORATION OF DROITWICH.
(GAS DEPARTMENT.)

THE Gas Committee invite Tenders for the supply of 1800 to 2000 Tons of Best Screened GAS COAL or NUTS during the ensuing Twelve Months, ending June 30, 1904, to be delivered at Droitwich (G.W. Rly.).
Specification and Form of Tender may be obtained on application to the Manager, Mr. S. G. Askew.
The Committee reserve the right to accept Tenders for the whole or any portion of the quantity offered, and do not bind themselves to accept the lowest or any Tender.
Sealed Tenders, endorsed "Tender for Gas Coal," to be sent to the undersigned not later than the 7th of July, 1903.
S. JNO. TOMBS,
Town Clerk.
Town Hall, Droitwich,
June 26, 1903.

URBAN DISTRICT COUNCIL OF WINSFORD.

THE above Council are prepared to re- ceive TENDERS for the supply of CANNEL and best screened GAS COAL, to be delivered at the Cheshire Lines Station, Winsford, or the Over and Wharton Station of the L. & N.W. Rly., or at the Council's Wharf on the River Weaver at Winsford. The Material is required for a Term of Twelve Months ending the 1st of August, 1904. The probable quantities required will be about 300 Tons of Cannel and about 1300 Tons of Gas Coal, which must be freshly wrought, well screened, and free from Sulphurous Pyrites and other Objectionable Matter; but the Council reserve the right of reasonably increasing or decreasing the quantities named. The person whose Tender is accepted will be required to enter into an agreement with the Council for the due performance of the Contract.
Sealed Tenders, stating price per ton, delivered as above, are to be received by the undersigned on or before the 14th of July, 1903, and endorsed "Gas Coal Tender."
The Council do not bind themselves to accept the lowest or any Tender.
Forms of Tender and further Particulars may be had on application to the Gas Manager, F. Sidwell, Winsford; or from
JNO. H. COOKE,
Clerk to the Council.
Council Offices, Russell Street,
Winsford, Cheshire, June 27, 1903.

DALTON-IN-FURNESS URBAN DISTRICT COUNCIL.

THE Lighting Committee are prepared to receive TENDERS for the supply of about 400 Tons of satisfactory GAS COAL, for the Year ending March 31, 1904.
Deliveries to be free to Askam-in-Furness Station, Furness Railway, and in quantities required.
The Committee also invite TENDERS for the surplus TAR and LIQUOR to be produced at their Works for the Year ending March 31, 1904.
Tenders, with full Particulars, to be forwarded to the undersigned, not later than July 15, 1903.
The lowest or any Tender not necessarily accepted.
W. RICHARDSON,
Surveyor.
Council Offices, Dalton-in-Furness,
June 23, 1903.

BOROUGH OF HEYWOOD.

THE Gas Committee invite Tenders for the supply of:
1—LIME.
2—TUBES AND FITTINGS.
3—SULPHURIC ACID.
Specification and Form of Tender may be obtained upon application to Mr. W. Whatmough, Gas Manager.
Contractors tendering for this work must pay their workpeople at least the Standard or Trade Union Rate of Wages, and observe the trade conditions which attach to the various kinds of work for which the Tender is sent in.
Sealed Tenders, endorsed, to be sent to me not later than Tuesday, July 14, 1903.
By order,
GEO. G. BOUCHIER,
Town Clerk.
Municipal Buildings, Heywood,
June 17, 1903.

CORPORATION OF LOUGHBOROUGH.
(GAS DEPARTMENT.)

TENDERS FOR TAR AND AMMONIACAL LIQUOR.

THE Gas Committee invite Tenders for the surplus TAR and AMMONIACAL LIQUOR for Twelve Months from July 1, 1903, to June 30, 1904.
Estimated amount of Tar, 600 Tons; Liquor, 1000 Tons. The Contractor to state Price for Water at 5° Twaddel and per Ton extra for every ½° above 5°.
The Corporation to deliver both Tar and Water into Contractor's boats at the Derby Road Wharf, Loughborough.
The Committee do not bind themselves to accept the lowest or any Tender, which is to be endorsed "Tender for Tar," and delivered to the undersigned at the Gas Offices, Loughborough, by Monday, the 6th of July, 1903.
By order,
EDWARD ONIONS,
Engineer and Manager.

CORPORATION OF LOUGHBOROUGH.
(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the above are prepared to receive TENDERS for the supply of the whole or part of 8500 Tons of best screened or unscreened GAS COAL, to be delivered at Loughborough Station at such times and in such quantities as may be required during the Year from July 1, 1903, to June 30, 1904.
Tenders, to be addressed to the undersigned, and to be delivered not later than Monday, the 6th day of July, 1903.
The Committee do not bind themselves to accept the lowest or any Tender, and reserve to themselves the power to accept a portion of a Tender.
By order,
EDWARD ONIONS,
Engineer and Manager.

BOROUGH OF DEWSBURY.

THE Corporation invite Tenders for the supply and delivery during the Twelve Months ending the 31st day of July, 1904, of:—
1—SULPHURIC ACID.
2—WET AND DRY GAS-METERS.
3—CAST-IRON GAS AND WATER PIPES.
Specification and Forms of Tender may be obtained on application to the Gas Engineer, Mr. Charles A. Craven, Gas-Works, Savile Town, Dewsbury.
Tenders, under sealed covers, endorsed "Sulphuric Acid," "Meters," or "Cast-Iron Pipes," as the case may be, to be sent to me not later than Wednesday, the 8th day of July next.
The Corporation do not bind themselves to accept the lowest or any Tender.
H. ELLIS,
Town Clerk.
Town Hall, Dewsbury,
June 23, 1903.

BOROUGH OF DEWSBURY.

THE Corporation invite Tenders for the supply and delivery at their Gas-Works Siding, Savile Town, Dewsbury, of the following quantities of screened GAS COAL, during One, Two, or Three Years, commencing on the 1st day of August next.

Tons.	Tons.
1st Year, 20,000	Black and 2000 Cannel.
2nd Year, 20,000	,, ,, 2000 ,,
3rd Year, 20,000	,, ,, 2000 ,,

Tenders must specify for delivery by rail, and be made on Forms to be had on application to Mr. Charles A. Craven, Savile Town Gas-Works, Dewsbury, from whom any further Information can be obtained.
Sealed Tenders, endorsed "Tender for Coal," to be sent to me, at the Town Hall, Dewsbury, not later than Wednesday, the 8th day of July next.
The Committee do not bind themselves to accept the lowest or any Tender.
H. ELLIS,
Town Clerk.
Town Hall, Dewsbury.
June 23, 1903.

THE Spalding Urban District Council invite TENDERS for the supply of Cast-Iron MAIN GAS-PIPES, from 3 inches to 12 inches in diameter, including the necessary SPECIAL CASTINGS for same.
For Particulars, apply to Mr. J. G. Hawkins, Gas Engineer, Spalding.
H. H. HARVEY,
Clerk to
Spalding Urban Council.
June 22, 1903.

CORPORATION OF ILKESTON.
(GAS DEPARTMENT.)

TENDERS FOR GAS COAL.

THE Gas Committee invite Tenders for 10,000 Tons of GAS COAL, NUTS or CANNEL, to be delivered at the Gas-Works Siding (Midland Rly.).
The Tenders must be on the usual Form to be obtained at the Gas Offices, and be endorsed "Coal," and sent to Wright Lissett, Esq., Town Clerk, not later than July 7, 1903.
The Committee do not pledge themselves to accept the lowest or any Tender, and reserve their right to divide the quantity.
F. C. HUMPHRYS,
Engineer and Manager.
Gas-Works, Ilkeston,
June 19, 1903.

RHYL URBAN DISTRICT COUNCIL.

TENDERS FOR COAL.

THE Rhyl Urban District Council are prepared to receive TENDERS for the supply of 4800 Tons of screened GAS COAL, to be delivered f.o.r. Rhyl, between Aug. 1, 1903, and June 30, 1904, in such quantities and at such times as may be required.
Form of Tender and Particulars of Conditions may be obtained on application to Mr. Leonard G. Hall, Assoc.M.Inst.C.E., Gas Engineer.
Sealed Tenders, endorsed "Tenders for Coal," to be delivered to me, the undersigned, on or before Tuesday, July 14.
Approved security will be required.
The Council do not bind themselves to accept the lowest or any Tender.
ARTHUR ROWLANDS,
Clerk to the Council.
Council Offices, Clwyd Street,
Rhyl, June 27, 1903.

LONDON COUNTY ASYLUM, HANWELL, W

THE Sub-Committee for the control and management of the above-named Asylum are prepared to receive OFFERS for the purchase of TAR and AMMONIACAL LIQUOR for the Twelve Months ending June 30, 1904.
Terms, Cash on removal.
Forms of Tender, with estimated quantities for Sale, may be obtained on application to the Resident Engineer at the Asylum.
Tenders must be sent, in sealed covers, endorsed "Tender for Tar and Liquor," to the undersigned by or before Ten o'clock a.m. on Saturday, July 4, 1903.
The Sub-Committee do not bind themselves to accept the highest or any Tender.
R. W. PARTRIDGE,
Clerk of the Asylums Committee.
London Asylums Committee Office,
6, Waterloo Place, London, S.W.,
June 23, 1903.

BOROUGH OF WORKINGTON.

TENDERS FOR GAS COAL.

THE Gas Committee of the Workington Corporation invite TENDERS for the supply of about 10,000 Tons of good GAS COAL, to be delivered free in quantities as required at the London and North-Western Railway Station in flat-bottom waggons or at the Quay Side, Workington, from the 1st of August, 1903, to the 1st of July, 1904.
Sealed Tenders, specifying Description and Quality of Coal offered, Analysis of same, and Pit in which it is raised, and the terms for net monthly payment, are to be sent, on or before the 13th of July, 1903, to the undersigned, endorsed "Tender for Coal."
Any other Information required may be obtained on application to Mr. George Keyte, Gas Manager, Gas-Works, Workington.
The Committee reserve the right to divide the above quantity into two or more Contracts.
The lowest or any Tender not necessarily accepted.
JOHN WARWICK,
Town Clerk.
Town Hall, Workington,
June 24, 1903.

KENT WATER-WORKS.

TENDERS FOR COAL.

THE Directors of the Kent Water-Works Company invite TENDERS for the supply of SCREENINGS from the Best Durham COAL at their Pumping-Stations at Crayford, Orpington, Wilmington, and Darenth, Kent, for One Year.
Approximate weekly quantities: Crayford and Wansunt, 55 to 130 Tons; Orpington, 30 to 50 Tons; Wilmington and Darenth, 100 to 160 Tons.
The Coal must be delivered in good and proper condition, and must evaporate not less than seven pounds of water for each pound of Coal, and be free from Slag or other Mineral or Earthy Matter. The percentage of Ash and Clinker to be adopted as the agreed limit will be specified.
Payments monthly upon Engineer's certificate.
The Directors do not bind themselves to accept the lowest or any Tender.
The Draft Contract can be inspected, and other Particulars obtained, at the Company's Offices, Mill Lane, Deptford.
Tenders, marked "Tender for Coal," to be transmitted under seal on or before Saturday, the 4th of July, to
A. DICKSON, jun.
Secretary of the Company.
June 25, 1903.

HEXHAM GAS COMPANY.

THE Directors of the above Company are prepared to receive TENDERS for the supply of about 4500 Tons of unscreened GAS COAL, to be delivered at Hexham Station as directed during the Year ending June 30, 1904.

Tenders, endorsed "Coal," to be forwarded to the undersigned not later than July 6, 1903.

HERBERT LEES,
Engineer and Secretary.

TO COLLIERY PROPRIETORS.

THE Corporation of Haverfordwest in- vite TENDERS for the supply of 1400 Tons of Double Screened GAS COAL and 300 Tons of STEAM COAL of the very best quality, to be delivered at the Haverfordwest Railway Station, or at the Gas-Works Quay, Haverfordwest, by water communication, in quantities as required by the Gas Manager during the Year commencing on the 1st day of September next.

Tenders by Friday, the 24th day of July, 1903.

Forms of Tenders and further Particulars of

R. T. P. WILLIAMS,
Town Clerk,
Haverfordwest.

Council Chamber, Haverfordwest,
June 26, 1903.

SAFFRON WALDEN UNION

TENDERS FOR COAL.

THE Guardians of the above Union are prepared to receive TENDERS for the supply of about 200 Tons of Best Hand-Picked Hard Steam COAL for Twelve Months, to be delivered at the Saffron Walden Railway Station each month as required.

Sealed Tenders, endorsed "Tender for Coal," to be sent to me, the undersigned, not later than Monday, the 4th prox.

The lowest Tender will not necessarily be accepted.

By order,

TURNER COLLIN,
Clerk.

Saffron Walden,
June 24, 1903.

BRIERLEY HILL DISTRICT GASLIGHT COMPANY.

TENDERS FOR TAR.

THE Directors invite Offers for the sur- plus TAR made at their Brierley Hill and Kingswinford Works, to be taken between Aug. 1 next and June 30, 1904, delivered into Buyer's Boats.

The Directors do not bind themselves to accept the highest or any Tender.

Tenders, to be addressed to the Chairman, endorsed "Tender for Surplus Tar," not later than July 16, 1903.

HENRY M. JACKSON
Secretary.

Board-Room, Gas-Works,
Brierley Hill, June 22, 1903.

THE Urban District Council of Hindley are prepared to receive TENDERS for two Shallow Generator GAS-RETORT SETTINGS and Connections Complete and Fixed in the existing Arches at the Gas-Works, Hindley.

For further Particulars apply to Mr. H. O. Timmins, Manager, Gas-Works, Hindley.

Sealed Tenders, endorsed "Retort-Settings," to be sent to the undersigned not later than Monday, July 13, 1903.

The Council do not bind themselves to accept the lowest or any Tender, and persons tendering must do so at their own cost.

By order,

THOMAS ROBEY,
Clerk to the Council.

Council Offices, Hindley,
June 25, 1903.

THE Sedgley Urban District Council invite TENDERS for one 10,000 cubic feet per hour EXHAUSTER and ENGINE, with Valves, Steam and Compensating Governors, &c., to be delivered, fixed, and started at their Gas-Works, Lower Gornal.

Also CAST-IRON BOTTOM BOX for 12-inch Condenser, with Valves, Seal Pot, Overflow, &c., delivered at these Gas-Works.

Any further Information may be obtained from Mr. J. Brettle, the Engineer and Manager at the Gas-Works.

Sealed Tenders, marked "Exhauster" or "Condenser," as the case may be, must reach me not later than July 8, 1903.

The Council do not bind themselves to accept the lowest or any Tender.

JOSEPH SMITH,
Clerk to the Council.

Council Offices, High Holborn,
Sedgley, June 23, 1903.

By Order of the Directors of the

CROYDON COMMERCIAL GAS AND COKE COMPANY.

SALE OF £2500 FIVE PER CENT. PERPETUAL DEBENTURE STOCK AND £5000 CONSOLIDATED "C" ORDINARY STOCK.

MESSRS. FOOKER and WEBB have received instructions to SELL BY AUCTION, at the Greyhound Hotel, Croydon, on Thursday, the 9th of July, at Six o'clock precisely, in Lots to suit buyers of large or small quantities, £5000 CONSOLIDATED "C" ORDINARY STOCK and £2500 FIVE PER CENT. PERPETUAL DEBENTURE STOCK of the Croydon Commercial Gas and Coke Company. The Dividends paid on the "C" Stock for some years have been at the rate of Nine per Cent. per annum, and since 1898 have been paid free of Income-Tax. The Reserve and Insurance Fund now amounts to £45,056 0s. 9d.

Particulars and Conditions of Sale may be had of the SECRETARY, at the Offices of the Company, Katharine Street, CROYDON; at the place of Sale; and of the AUCTIONEERS, 4, High Street, CROYDON. Telephone, No. 122.

COALVILLE URBAN DISTRICT COUNCIL.

(GAS DEPARTMENT.)

THE above Council invite Tenders for the supply of 1500 Tons of GAS COAL or NUTS delivered in Waggons to Coalville (Midland Railway) between July 1, 1903, and June 30, 1904, in such quantities, monthly, as required.

The Council reserve the right to divide the quantity.

The lowest or any Tender not necessarily accepted.

Tenders, endorsed "Coal," addressed to the Chairman of the Gas Committee, to be delivered at the Gas Office, Whitwick, Leicestershire, on or before July 11, 1903.

No Forms supplied.

JOS. W. EAGLES,
Manager.

Gas-Works, Whitwick,
June 19, 1903.

ISSUES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MR. ALFRED RICHARDS begs to notify that his ISSUES by AUCTION under PARLIAMENTARY POWERS of STOCKS and SHARES in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.

Terms for Issuing such Capital, and also for including Gas and Water Stocks and Shares belonging to Private Owners in these Periodical Sales, can be obtained on application at Mr. ALFRED RICHARDS' OFFICES, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

HARWICH GAS AND COKE COMPANY.

NEW ISSUE OF 500 £5 ADDITIONAL SHARES.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, July 6, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

TENDRING HUNDRED WATER-WORKS COMPANY.

(Incorporated in 1884), supplying Harwich, Parkeston, and the East Coast Resorts of Dovercourt, Walton-on-Naze, and Frinton-on-Sea, &c.

SALE BY AUCTION OF 500 £10 "A" SHARES.

Ranking up to 8 per cent. Dividend equally with the existing "A" Shares, which have received 4½ per cent. for the last Six Years.

The Water Revenue has risen from £3900 in 1897 to £6638 at the present time; and this new Capital is required for Works necessitated by the increasing demand for Water, the result of the continued development of the district.

MR. ALFRED RICHARDS will Issue the ABOVE BY AUCTION, at the Mart, London, E.C., on Monday, July 6, 1903, at Two o'clock, in Lots, by order of the Directors.

Particulars of Sale, with Form of Instructions for the Auctioneer or Secretary to purchase for Investors unable to attend the Auction, obtainable post free of the SECRETARY of the Company, MISTLEY, ESSEX, or of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

By order of the Directors of the

SOUTH ESSEX WATER-WORKS COMPANY.

NEW ISSUE OF £9750 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, Tokenhouse Yard, E.C., on Tuesday, July 14, at Two o'clock, in Lots.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

SUTTON DISTRICT WATER COMPANY.

£500 ORDINARY STOCK.

MR. ALFRED RICHARDS will Sell the ABOVE BY AUCTION, at the Mart, E.C., on Monday, July 6, a Two o'clock.

Particulars of the AUCTIONEER, 18, FINSBURY CIRCUS, E.C.

COUNTY BOROUGH OF SWANSEA,

SOUTH WALES.

By Order of the Directors of

THE SWANSEA GASLIGHT COMPANY.

MESSRS. JOHN M. LEEDER & SON have received instructions to offer for SALE BY PUBLIC AUCTION, at the Hotel Métropole, Swansea, on Tuesday, July 7, 1903, at 2.30 for 3 o'clock, p.m., precisely.

£35,000 NEW ORDINARY STOCK

(Entitled to 5 per cent. per annum Interest), and

£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK

OF AND IN

THE SWANSEA GASLIGHT COMPANY,

Being part of the Additional Capital of the Company authorized to be raised by the Swansea Gas Act, 1898, and pursuant to the Provisions and Conditions therein contained.

Purchasers of the New Ordinary Stock, 1898, will be entitled to six Months Interest (at 5 per cent. per annum), free of Income-Tax, as from the 1st of July, 1903, payable on the 1st of April, 1904; and purchasers of the 4 per cent. Perpetual Debenture Stock, 1898, to Six Months' Interest due and payable on the 1st of January, 1904.

Particulars and Conditions of Sale, containing all necessary Information, may be obtained on application to THORNTON ANDREWS, ESQ., Secretary and Manager of the Swansea Gaslight Company, Oystermouth Road, SWANSEA, and at the AUCTIONEERS' OFFICES, 46, Waterloo Street, SWANSEA.

TAR Contracts Wanted on the Sliding- Scale or at Fixed Prices

Managers and Secretaries desirous of selling to best advantage please communicate with DENT AND CO., Ouse Chemical Works, SELBY.

THE GASLIGHT AND COKE COMPANY

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to CAPITAL STOCKS, WILL BE CLOSED at Four o'clock p.m. on Tuesday, the 7th day of July next, and WILL BE RE-OPENED immediately after the Half-Yearly Ordinary General Meeting of the Company to be held on the 7th day of August next.

By order

JOHN WILLIAM FIELD,
Secretary and General Manager.

Chief Office: Horseferry Road,
Westminster, S.W., June 25, 1903.

THE RUGBY GAS COMPANY.

(INCORPORATED BY THE RUGBY GAS ACT, 1882.)

250 SHARES OF £10 EACH (Additional Capital), or such less number as shall be declared at the time of Sale.

TO BE SOLD by Auction, by Mr. JOHN R. TAIT, at the Royal George Hotel, in Rugby, on Friday, the 3rd day of July next, at Four o'clock in the afternoon precisely, by order of the Company (under the provisions of the Rugby Gas Act, 1882),

IN LOTS OF 5 SHARES EACH.

The above Shares are part of the Authorized Additional Capital of the Company, and bear the standard dividend of £7 per cent., subject, under the Sliding-Scale, to increase or diminution with the price charged for Gas.

The present price of gas admits of a dividend on these shares of £10 per cent. per annum.

The dividend on the Original Capital of the Company for the past three years has been £13 per cent. per annum.

Particulars and Conditions of Sale may be obtained, on or after the 10th of June inst., at the Offices of the Company, Railway Terrace, Rugby; of the AUCTIONEER, Albert Street, Rugby; of Messrs. WRATISLAW and THOMPSON, Solicitors, Rugby; or from the undersigned.

T. M. WRATISLAW,
Secretary to the Company.

Rugby.
Dated the 4th day of June, 1903.

The Circular from which this advertisement is abridged has been filed with the Registrar of Joint-Stock Companies, in accordance with the Companies Act, 1900.

THE HIGH WYCOMBE GASLIGHT AND COKE COMPANY, LIMITED.

SALE BY TENDER OF 800 PREFERENCE SHARES OF £5 EACH,

which will be entitled to a fixed Preferential Dividend of £5 per centum per annum, to be paid out of the profits of each year, and to rank, both as regards Capital and Dividend, in priority to the Ordinary Shares of the Company, and *pari passu* with the existing Preference Shares of the Company and any future issue of Preference Shares authorized to be raised under the powers of the High Wycombe Gas Order, 1901.

The Minimum Price of each Preference Share is £5; and the Minimum Subscription upon which the Directors will proceed to allotment is 600 Shares of £5 each.

A deposit of 10s. per Share must accompany each Tender, and the balance of the Purchase Money shall be paid on or before the 14th day of August next.

Applications must be lodged in sealed envelopes, marked "Tender for Preference Shares," at the Offices of the Company, Gas-Works, Newland, High Wycombe, or through their Bankers, the Capital and Counties Bank, Limited, at their Head Office, at their High Wycombe Branch, or any other of their Branches, not later than Four o'clock in the Afternoon, on Friday, the 17th day of July next.

The Shares will be allotted to the persons making the highest Tenders, subject to Clause 8 of the High Wycombe Gas Order, 1901.

The following are the Particulars of previous offers of Shares, and the amounts paid on such Shares; the whole amount offered having in each case been allotted:—

No of Shares offered and allotted.	Amounts paid thereon. £	s.	d.
1480 £5 Ordinary	7400	0	0
1480 £2 do.	2960	0	0
280 £5 do.	2198	15	0
200 £5 do.	1598	0	0
800 £5 do.	6475	0	0
1000 £5 do.	7817	0	0
800 £5 Preference	4000	0	0

No Shares of the Company have been issued or agreed to be issued otherwise than in Cash.

Loan Capital, consisting of £6100 £4 per cent. Mortgage Debentures, has been issued; and a further sum of £8150 is authorized, but unissued.

The net Premium Capital of the Company amounts to £6544 11s. 7d., which is available for use in the undertaking, but entitled neither to Interest nor Dividend. The Reserve Fund amounts to £1072 0s. 6d.

The Company's business has progressed from 8,202,700 cubic feet sold to 418 Consumers in 1872, to 44,421,200 cubic feet sold to 1824 Consumers last year. The selling price is 4s. 2d. per 1000 cubic feet, less discounts.

The Capital now to be raised is required for Extensions of Mains and General Working Purposes.

No material Contracts have been entered into by the Company within Two Years immediately preceding the publication of this Circular, save such as have been entered into in the ordinary course of the Company's business.

The Auditors of the Company are Messrs. Lass, Wood, and Drew, of 30, Gracechurch Street, London.

Full Particulars and printed Forms of Tender can be obtained of the Secretary to the Company, Gas-Works, Newland, High Wycombe, or of Messrs. Clarke and Son, Solicitors, High Wycombe.

June 18, 1903.

BOOKS AND LEAFLETS

TO BE OBTAINED OF

WALTER KING,

11, BOLT COURT, FLEET STREET, E.C.

HANDBOOK FOR GAS ENGINEERS AND MANAGERS.—By THOMAS NEWBIGGING, M.Inst.C.E. (New Edition in course of Preparation).

INTERNATIONAL ENGINEERING CONGRESS (GLASGOW, 1901)—THE PROCEEDINGS OF THE GAS SECTION. Edited by J. W. HELPS, M.Inst.C.E. *Price* 5s.

BIRMINGHAM CORPORATION (Windsor Street) GAS-WORKS.—By CHARLES HUNT, M.Inst.C.E. *Price* 21s.

CONSTRUCTION OF GAS-WORKS.—By S. HUGHES. *Price* 5s. 6d.

GAS LIGHTING.—By CHARLES HUNT. *Price* 18s.

GAS MANUFACTURE FOR STUDENTS.—By J. HORNBY. *Price* 5s.

GAS ENGINEERS' POCKET BOOK. — By H. O'CONNOR. *Price* 10s. 6d.

MODERN METHODS OF SAVING LABOUR IN GAS-WORKS.—By C. E. BRACKENBURY. *Price* 3s. 6d.

MODERN APPLIANCES IN GAS MANUFACTURE —By FLETCHER W. STEVENSON. *Price* 5s.

ZURICH NEW GAS-WORKS.—By A. WEISS, Engineer of the Works. *Price* 2s. 6d.

THE GUIDE-FRAMING OF GASHOLDERS, and other Papers.—By F. SOUTHWELL CRIPPS, Assoc. M.Inst.C.E. *Price* 6s.

GASHOLDER AND TANK AT THE SUTTON GAS-WORKS (one million cubic feet capacity).—By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E. *Price* 3s. 6d.

GASHOLDERS WITH OR WITHOUT GUIDE-FRAMING.—A Discussion between E. LLOYD PEASE and F. SOUTHWELL CRIPPS. *Price* 1s.

THE VALUATION OF GAS, ELECTRICITY, AND WATER-WORKS FOR ASSESSMENT PURPOSES.—Second Edition. By THOMAS NEWBIGGING, M.Inst.C.E., and WILLIAM NEWBIGGING, Assoc.M.Inst.C.E. *Price* 5s.

LAW RELATING TO GAS AND WATER.—By J. SHIRESS WILL, K.C. Fifth Edition. *Price* 35s.

REESON'S COMPLETE GAS AND WATER ACTS.—By JOSEPH REESON. *Price* 21s.

THE POWERS OF CHARGE OF THE METROPOLITAN GAS COMPANIES.—By LAURENCE W. S. ROSTRON, M.A., B.C.L., of New College, Oxford, and Lincoln's Inn, Barrister-at-Law. With a Preface by GEORGE LIVESEY, M.Inst.C.E. *Price* 6s.

LAW OF LONDON GAS COMPANIES.—By T. J. BARNES. *Price* 6s.

PRECEDENTS IN PRIVATE BILL LEGISLATION AFFECTING GAS AND WATER UNDERTAKINGS, 1891-1901 (the Volume for 1879-1890 is still on Sale).—By E. H. STEVENSON and E. K. BURSTAL, MM.Inst.C.E. *Price* 21s.

CONSPIRACY AND PROTECTION OF PROPERTY ACT.—*Price* 2s. *per dozen*, or 10s. 6d. *per* 100.

MOND GAS SCHEME.—By F. N. KEEN, of the Middle Temple, Barrister-at-Law. *Price* 1s.

CALORIMETRY OF PRODUCER AND ILLUMINATING GASES.—By JOHN F. SIMMANCE, Assoc. M.Inst.C.E., M.Inst.Mech.E. *Price* 2s.

PRACTICAL PHOTOMETRY: A GUIDE TO THE STUDY OF THE MEASUREMENT OF LIGHT.—By W. J. DIBDIN, F.I.C., F.C.S., late Chemist and Superintending Gas Examiner to the London County Council. *Price* 7s. 6d.

"CHEMICAL TECHNOLOGY"—ELECTRIC LIGHTING. By A. G. COOKE, M.A., A.M.Inst.C.E. PHOTOMETRY: W. J. DIBDIN, F.I.C., F.C.S. 1 Vol. *Price* 2Cs.

COAL TAR AND AMMONIA.—By GEORGE LUNGE, Ph.D. Third Edition. *Price* 42s.

TREATISE ON THE MANUFACTURE OF SULPHURIC ACID.—By GEORGE LUNGE, Ph.D. *Price* 42s.

GAS ANALYSTS' MANUAL.—By JACQUES ABADY. *Price* 18s.

GAS ENGINEERS' LABORATORY HANDBOOK.—By J. HORNBY. *Price* 6s.

GAS AND FUEL ANALYSIS.—By A. H. GILL, *Price* 5s. 6d.

TECHNICAL GAS ANALYSIS. — By CLEMENS WINKLER. Second Edition. *Price* 10s. 6d.

THORPE'S DICTIONARY OF APPLIED CHEMISTRY, Vol. 2. Articles on Gas recommended for Students by City and Guilds Institute. *Price* 42s.

CHEMISTRY FOR ENGINEERS AND MANUFACTURERS. Vol. II. — By BLOUNT and BLOXAM. *Price*, 16s.

METHODS OF GAS ANALYSIS.—By Dr. WALTHER HEMPEL. Translated from the third German edition and considerably enlarged by L. M. DENNIS. *Price* 10s.

NOTES ON THE LITHOLOGY OF GAS COALS, WITH LIST OF COMMERCIAL ANALYSES.—By JAMES PATERSON, C.E., F.G.S. *Price* 3s.

ANALYSES OF SCOTCH COALS, CANNEL, SPLINT, SHALE, &c., USED IN THE MANUFACTURE OF GAS.—By (the late) Dr. WILLIAM WALLACE, of Glasgow. *Price* 1s.

GAS, OIL, AND AIR ENGINES.—By (the late) BRYAN DONKIN. *Price* 25s.

THE SCIENCE AND PRACTICE OF LIGHTING AS APPLIED TO STREETS, OPEN SPACES, AND INTERIORS.—By W. H. Y. WEBBER. *Price* 3s. 6d.

PUBLIC LIGHTING BY GAS AND ELECTRICITY —By W. J. DIBDIN, F.I.C., F.C.S. *Price* 21s.

GAS AND GAS-FITTINGS.—By H. F. HILLS, F.C.S. *Price* 5s.

HANDBOOK OF PRACTICAL GAS-FITTING.—By W. GRAFTON. *Price* 5s.

THE FLOW OF GASES AND PROPORTIONING GAS-MAINS. — By F. SOUTHWELL CRIPPS, Assoc. M.Inst.C.E. *Price* 7s. 6d.

A LEAFLET ON SULPHATE OF AMMONIA: ITS SOURCE; RELATIONSHIP TO SOIL; EFFECT ON PLANTS.—By H. H. COUSINS, M.A., South-Eastern Agricultural College, Wye. *Price* 7s. 6d. *per* 100; £3 *per* 1000.

THE

PETROLEUM GAS SYNDICATE

Supply and erect Complete Installations of their

PETROGENE PATENT GAS PLANT

On SALE, HIRE, or ROYALTY.

PETROGENE GAS is the most suitable Illuminant for all Towns, Villages, Factories, Institutions, &c., where a Cheap and Efficient Lighting System is required. It is equally suitable for Heating and Power purposes, and may be used with ordinary Gas Fittings, Stoves, Engines, &c. It may also be used in conjunction with Coal Gas, and affords Gas Companies a ready means of increasing their output without the expense of additional storage.

The Syndicate is prepared to entertain offers of sale of small Gas-Works, whether profit earning or not.

Offices: **28, Victoria St., Westminster.**
Works: **10, Rochester Row, S.W.**

ROBERT MARSHALL,

CANNEL COAL MERCHANT,

97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

THOMAS DUXBURY & CO.,

16, DEANSGATE, MANCHESTER.

Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.

Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.

PRICE'S COKE & COAL BARROW

effects a great saving of time, labour, and expense.

For Particulars Price, &c., apply to Mr. EDWARD PRICE, "Langley," Wyke Avenue, WORTHING.

WELDON MUD

FOR

GAS PURIFICATION,

For use in the

RECOVERY OF SULPHUR

Also Removal of last Traces of

SULPHURETTED HYDROGEN

in catch position.

Full Particulars on application to the Patentees:

GAS DESULPHURIZATION CO.,

— LIMITED, —

1, FENCHURCH AVENUE, LONDON, E.C.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

THOMAS TURTON AND SONS, LIMITED,

SHEAF WORKS, SHEFFIELD,

MANUFACTURERS OF

FILES OF BEST QUALITY FOR ENGINEERS.

STEEL OF ALL DESCRIPTIONS.

SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES, AND ENGINEERS' TOOLS GENERALLY.

LONDON OFFICE:

90, CANNON STREET, E.C.

HARPER & MOORES, Limited,

STOURBRIDGE.

MANUFACTURERS OF

Inclined, Horizontal, and Segmental

GAS-RETORTS,

Fire-Bricks, Fire-Clay Lumps, and Tiles

OF EVERY DESCRIPTION.

Also Manufacturers of **Cast-Iron Retorts, Iron Mouthpieces, Pipes, and all necessaries for Gas-Works requirements.**

Telegraphic Address: "MOORES, LYE. Telephone No. 23 Lye.

THOMAS BUGDEN, MANUFACTURER OF

TAR and LIQUOR HOSE, and Special AIR TUBING.

BELLOWS made to inflate a 48-inch Bag under One Minute. Various sizes made.

STOKERS' MITTS.
Made from best Tanned Leather.

India-rubber Goods of every description, Leather Bands Oils, &c., Diving and Wading Dresses, Waterproof, Coat Capes, Sewer Boots, and Theatrical Dresses.

Fire-Engine Hose and Appliances.

Best Materials and Workmanship Guaranteed.

Gas-Bags for Mains. All Seams stitched.

Miners' Woollen Jackets No. 1, 12/- each; No. 2, 9/6.

71, GOSWELL ROAD, E.C.

TROTTER, HAINES, & CORBETT,
LIMITED,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS-RETORTS GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

LONDON OFFICE: R. CULL, 34, OLD BROAD STREET, E.C.

THE
"ROTARY"
STATION METER.

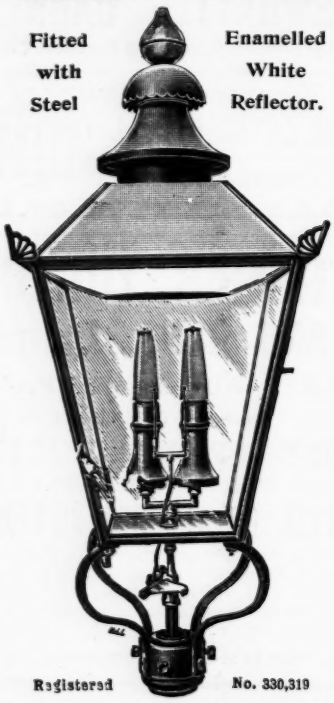
Efficiency Demonstrated.

APPLY—
T. G. MARSH,
MAWSON CHAMBERS, DEANSGATE,
MANCHESTER.

THE
"KILBURN" LANTERN.

Fitted with Steel

Enamelled White Reflector.



Registered No. 330,319

The "Kilburn" Lantern (for double lights) and the "St. Albans" Lantern have been adopted for lighting the Town of St. Helens.

H. GREENE & SONS, Limited,
Surrey Engineering Works,
Blackfriars Road, LONDON.
Telephone 1693 HOP.
Telegrams: "LUMINOSITY LONDON."

COKE-BREAKERS,
PRICES REDUCED.
(THOMAS & SOMERVILLE'S PATENT)
With Elevators and Conveyors worked by Steam or Gas Engine.
GEORGE WALLER & SON,
165, QUEEN VICTORIA STREET, E.C.;
And at STROUD, GLOUCESTERSHIRE.

UNEQUALLED.
Gas Companies are solicited to try Samples of the
MIRFIELD
BLACK BED GAS COAL.
Prices and Analysis on application.
MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

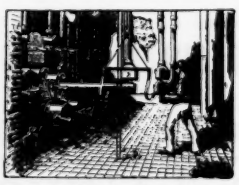
High Grade
Gas-Cookers
at
Bottom Prices.

OUR COOKERS
Save you considerable trouble, and
GIVE
Increased Profit to your Company.

THE IMPERIAL STOVE CO.,
LEAMINGTON SPA.
Telegrams: "Imperial, Leamington."
Telephone: One X.

ATTERTON'S
CHARGING APPARATUS

Nearly **40** of these Machines have been



supplied to English Gas-Works.

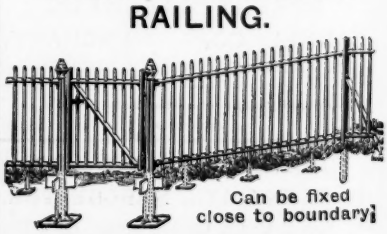
Sole Agents for the United Kingdom:
E. PADFIELD & CO.,
96 & 98, LEADENHALL STREET, E.C.
Representatives:
Messrs. BELL & CO., Engineers, CARDIFF,
Mr. J. B. MACDERMOTT, GLASGOW, and
J. BYRON MACKENNA, DUBLIN

HEATHCOTE GAS COAL.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.
THE GRASSMOOR CO., LD.,
CHESTERFIELD.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road CITY ROAD, LONDON, N.,
Manufacture and keep in Stock at their Works (also large stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY'S PATENT SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

BAYLISS.
JONES,
AND
BAYLISS
LIMITED,
Manufacturers of
IRON FENCING, &c.

PATENT SELF-ADJUSTING
RAILING.



Can be fixed close to boundary.

COKE BARROWS.

LIST FREE.

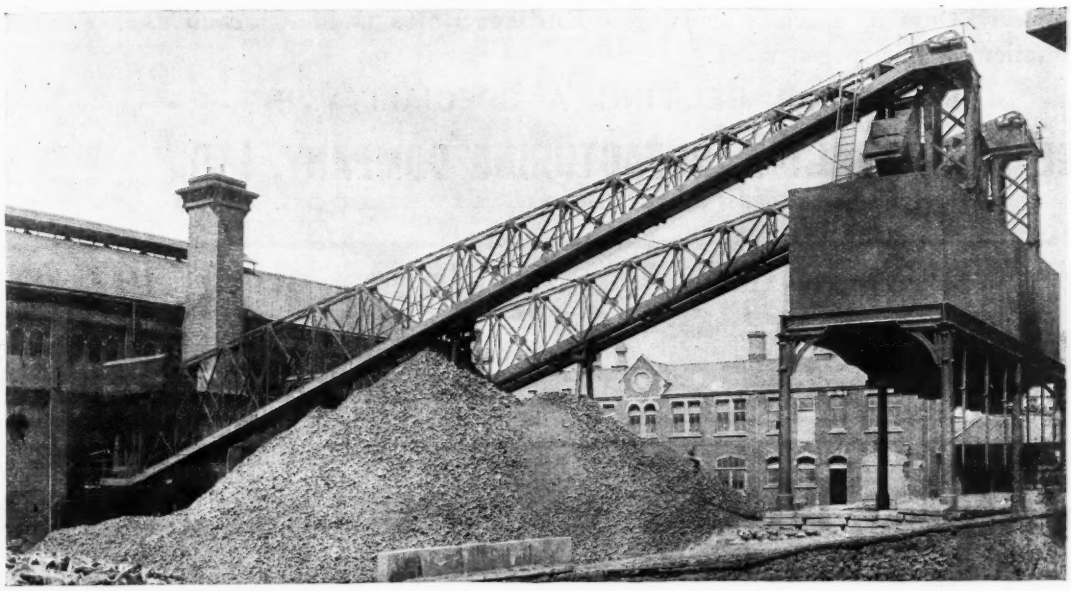
ILLUSTRATED CATALOGUE OF ALL KINDS OF HANDLES, FENCING, GATES, &c., FREE
VICTORIA WORKS, WOLVERHAMPTON.
LONDON OFFICES AND SHOW ROOMS—139 & 141, CANNON STREET, E.C.

THE WIGAN COAL & IRON CO., LIMTD.,
Are exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, and supply the Best Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, &c.
MIDLAND AND WEST OF ENGLAND DISTRICT OFFICE: *6, CORPORATION STREET, BIRMINGHAM—Sole Agent: A. C. SCRIVENER.*
Telegraphic Address: "WIGAN, BIRMINGHAM." Telephone No. 200.
LONDON DISTRICT OFFICE: *6, STRAND, LONDON—C. PARKER & SON, Sole Agents.*
Telegraphic Address: "PARKER, LONDON."

THE

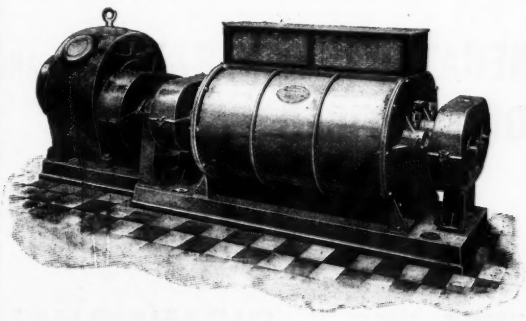
DE BROUWER PATENT HOT COKE CONVEYOR

GUARANTEED BY SOLE MAKERS.



W. J. JENKINS & Co., LIMITED, RETFORD.

THWAITES BROS., LD.,



MECHANICAL ENGINEERS,

BRADFORD.

ROOTS' BLOWERS

IN ALL SIZES TO DELIVER UP TO

25,000 cubic feet of Air per minute.

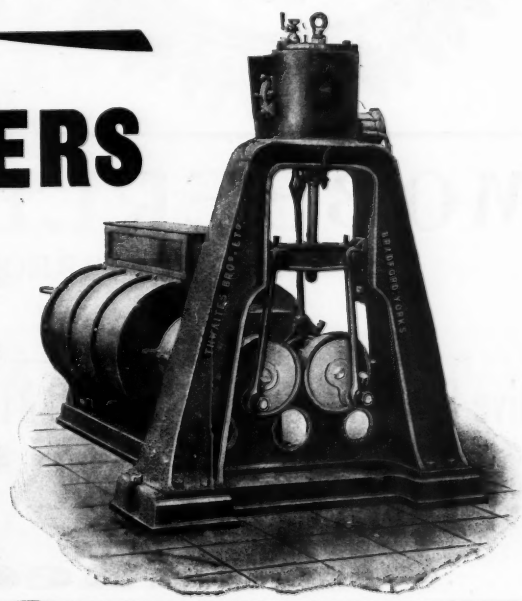
Driven by Engine, Belt, or Motor.

SPECIALLY DESIGNED AND OF

MODERN CONSTRUCTION

. . For all Processes of . .

GAS MANUFACTURE.



GANDY'S BELTING

Holds the World's Record! 41 Prize Awards!

IN A WATER-GAS PLANT, an important item is the Belt for driving the Blower. Ours are specially constructed **Endless Belts,** and have acquired a reputation for this special Work.

CONVEYOR BELTING—A SPECIALITY.

THE GANDY BELT MANUFACTURING COMPANY, LTD.,

HEAD OFFICES AND WORKS—**SEACOMBE, LIVERPOOL.**

This Trade Mark may be seen stencilled on every genuine "Gandy" Belt.

Wrought-Iron

And Fittings & Accessories.

LAMBERT BROS., WALSALL,

MANUFACTURERS OF

WROUGHT-IRON TUBES & FITTINGS for GAS, WATER, & STEAM.

BRASS GAS-FITTINGS, GAS-VALVES, STEAM & WATER VALVES, TOOLS, &c., AND OF WARNER'S PATENT MARKET GAS STAND-PIPE.

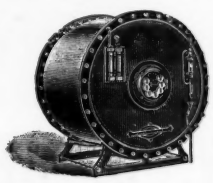
LONDON: LAMBETH BRASS & IRON CO., LTD., 91 & 93, SOUTHWARK ST., S.E.

JAMES MILNE & SON, LTD:,

GAS ENGINEERS

MILTON HOUSE WORKS EDINBURGH.

LONDON. —— LEEDS. —— GLASGOW.



GAS

THE WINSTANLEY SPECIALTY COY.

ENGINEERS

GAS ENGINEERS.

CONTRACTORS FOR, AND ERECTORS OF, ALL GAS-WORKS PLANT.

REGENERATORS, GENERATORS, AND DIRECT-FIRED RETORTS.

RESULTS GUARANTEED.

COMPLETE INSTALLATIONS OF HORIZONTAL AND INCLINED RETORTS.

ADDRESS—

NEWTON CHAMBERS, CANNON ST., **BIRMINGHAM.**

MOBBERLEY & PERRY,

GAS RETORT, FIRECLAY, AND BRICK WORKS,

STOURBRIDGE.

Give SPECIAL and PERSONAL ATTENTION to the execution of all orders

Large Stocks kept.

SPECIALS FOR WATER GAS PLANTS.

Inclined Retorts.

SAML. CUTLER & SONS, MILLWALL, LONDON.

GASHOLDERS OF EVERY DESCRIPTION.

CUTLER'S PATENT GUIDE FRAME FOR GASHOLDERS

Adopted for many large and important Gasholders.

CUTLER'S PATENT FREEZING PREVENTER

FOR GASHOLDER CUPS AND TANKS.

In extensive use in English, Continental, and American Works.

LARGE STEEL TANKS A SPECIALITY

Gasworks Plant of every kind.

STEEL FRAMED BUILDINGS.

RETORT-HOUSE ROOFS. BENCH IRONWORK.

CARBURETTED WATER GAS PLANT.

CUTLER'S PATENT INTERLOCKING GEARS.
CUTLER'S PATENT OIL SPRAYERS.
CUTLER'S PATENT TAR SEPARATOR.
CUTLER'S PATENT DUST INTERCEPTOR.

PATENT WATER TUBE CONDENSERS

OIL-TANKS. CHEMICAL PLANT.

Makers of all kinds of Constructional Ironwork.

Foap. Fol., 28 pp., 2 Plates, and 48 Illustrations, Bound in Duplex Paper Cover, Price 2s. 6d. net, post free.

A DESCRIPTION
OF THE
ZURICH NEW GAS-WORKS.
By A. WEISS, Engineer of the Works.
Translated from the German for, and Reprinted from, the "JOURNAL."

LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C.

GIBBONS BROS., LTD.,
Tel. Address: "GIBBONS LOWER GORNAL." **DUDLEY.** Telephone No. 10A, DUDLEY EXCHANGE.
Gas Engineers, Contractors, Retort Setters.

INSTALLATIONS OF INCLINED RETORTS COMPLETE.

ELEVATORS AND CONVEYORS A SPECIALITY

Installation of 10 Settings of 8 Inclined Retorts recently erected by us.

PATENT REGENERATIVE SETTINGS
GIBBONS' & MASTERS' PATENT No. 1269, 1893.
SUITABLE FOR WORKS OF EVERY CAPACITY.
And a special Form of which is applicable to
GASEOUS FIRING WITH A MINIMUM EXCAVATION.

RETORT BENCH IRONWORK CONDENSERS,	*SCRUBBERS, PURIFIERS, VALVES, ROOFS,*	*GIRDERS AND STRUCTURAL IRONWORK.*

DESIGNS AND ESTIMATES ON APPLICATION.

WILSON CARTER & PEARSON
LIMITED,
GAS COAL AND CANNEL FACTORS,
Supply to any Railway Station, or for Export, all kinds of Fuel for Gas and Other Purposes.
ADDRESS CHIEF OFFICES:
Temple Buildings, 50, New Street, Birmingham.

JOSEPH CLIFF & SONS
(BRANCH OF THE LEEDS FIRE-CLAY CO., LTD.),
WORTLEY, LEEDS.

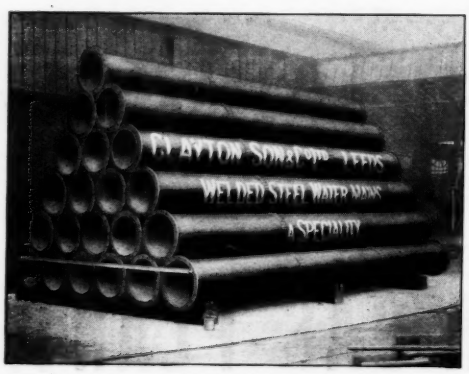
Cliff's Wortley Silica Bricks.

FOR Arches and Crowns where high heats are required. They contain over 90 per cent. of Silica, and are nearly stationary under the influence of heat, swelling a little rather than contracting. They are not like a Gannister or Dinas Brick, but a Fire-Brick of a highly Silicious nature.

Cliff's Wortley Aluminous Bricks.

THESE are for Side Walls where great wear and tear takes place. Are made of a specially prepared mixture, are high in Alumina, and are what is termed a HARD FIRE-BRICK.

BALTIC WHARF, WATERLOO BRIDGE, LONDON, S.E.
Liverpool: Leeds Street. Leeds: Queen Street.



WELDED OR RIVETED STEEL PIPES
A SPECIALITY
FOR ALL PURPOSES, TO STAND ANY PRESSURE AND PASS ANY INSPECTION.
CONTRACTS UNDERTAKEN FOR ANY LENGTH OF
PIPE LINE For Water, Steam, Oil, Hydraulic, or Pneumatic Pressure; also for Gas or Air. Any diameter from eight inches upwards.
COMPLETE GAS PLANTS.
CLAYTON SON & Co. LTD. LEEDS.
ALSO MAKERS OF
STEEL STORAGE TANKS.
Structural Iron & Steel Work,
HIGH-CLASS BOILERS,
For High Pressures, fitted with DEIGHTON'S PATENT CORRUGATED FLUES, giving increased heating surface and highest economy in working.
ON ADMIRALTY AND WAR OFFICE LISTS.

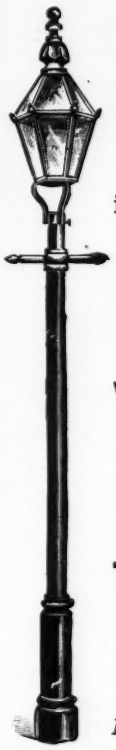
JOHN BROWN & CO., LTD., SHEFFIELD.
Proprietors of
ALDWARKE MAIN, CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 Feet of 19-Candle Gas per Ton.
Value in Pounds of Sperm, 820·80.
VERY FREE FROM IMPURITIES.
TELEGRAMS: "ATLAS, SHEFFIELD."

BOWENS' Ltd. Successors,
STOURBRIDGE.

MANUFACTURERS OF
BEST FIRE-BRICKS; INCLINED, HORIZONTAL, and SECTIONAL RETORTS; LUMPS, TILES, &c., of every description.
ESTABLISHED 1860.

CLAYTON SON & Co Ltd LEEDS
MAKERS OF THE LARGEST GASHOLDER IN THE WORLD ALSO
THE ORIGINAL MAKERS OF
SPIRAL GUIDED GASHOLDERS
MAKERS OF ALL KINDS OF STRUCTURAL IRON & STEEL WORK. STEEL FRAMED BUILDINGS ROOFS RETORT FITTINGS PURIFIERS RETORT LIDS ANTIFREEZERS for Gasholders
STEEL TANKS
OF ALL SIZES
MAKERS OF THE LARGEST IN THE WORLD.
GASHOLDERS
OF EVERY DESCRIPTION & SIZE.
HIGH CLASS BOILERS FITTED WITH DEIGHTON'S PATENT CORRUGATED FLUES.
Telegrams "GAS LEEDS." London Office 60 Queen Victoria St E.C.

MANNESMANN

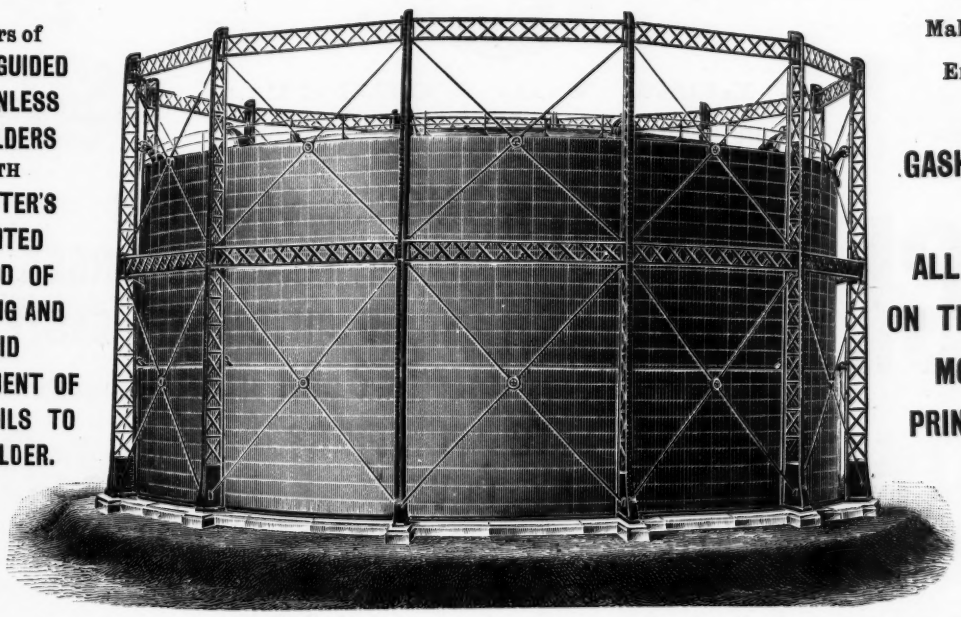


LAMP POSTS
made throughout of
WELDLESS STEEL TUBING
including base, ring, and ladder rest.
Light, Strong, Unbreakable, and Cheap.
GAS, WATER, & STEAM TUBES AND FITTINGS.
WELDLESS STEEL SPIGOT & FAUCET PIPES for Gas and Water Mains.
Tubes can be supplied up to 10 inches diameter and in lengths up to 30 feet.
THE BRITISH MANNESMANN TUBE COMPANY, LTD.,
Landore, South Wales.
Birmingham Depôt: 110, COLMORE ROW.
London Office: 110, CANNON STREET, E.C.

R. & J. DEMPSTER, LTD.. GAS PLANT WORKS,
OLDHAM ROAD, MANCHESTER.

Telegraphic Address "SCRUBBER, MANCHESTER." National Telephone Nos. 54 and 2296.

Makers of SPIRAL-GUIDED COLUMNLESS GASHOLDERS WITH DEMPSTER'S PATENTED METHOD OF SHEETING AND RIGID ATTACHMENT OF GUIDE-RAILS TO GASHOLDER.



Makers and Erectors of GASHOLDERS OF ALL SIZES, ON THE MOST MODERN PRINCIPLES.

London Office: 165, GRESHAM HOUSE, OLD BROAD STREET, E.C.

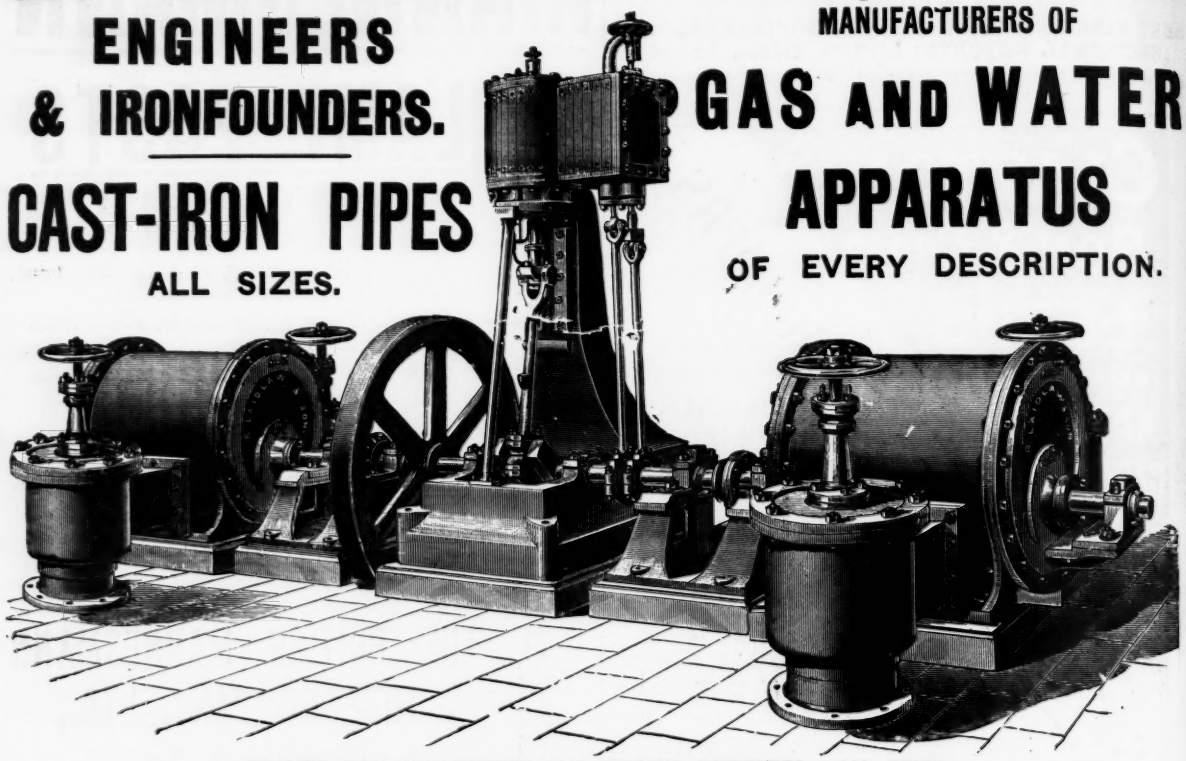
R. LAIDLAW & SON, LIMITED.

ENGINEERS & IRONFOUNDERS.

MANUFACTURERS OF

GAS AND WATER APPARATUS OF EVERY DESCRIPTION.

CAST-IRON PIPES ALL SIZES.



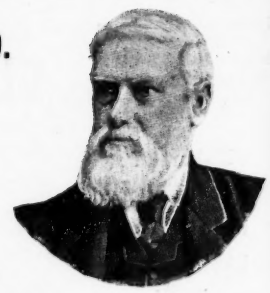
BEALE'S GAS EXHAUSTERS AND ENGINE COMBINED—ALL SIZES.

ALLIANCE FOUNDRY GLASGOW. | SIMON SQUARE WORKS, EDINBURGH. | 6, LITTLE BUSH LANE, LONDON, E.C.

CLAPHAM BROTHERS

ESTABLISHED 1837.

LIMITED.



LEST YOU FORGET!

OUR SPECIALITIES ARE IN GREAT FAVOUR.

"ECLIPSE"

WASHER SCRUBBER (Laycock and Clapham's Patent).

WATER TUBE CONDENSER (Clapham's Patent).

RAPID AUTOMATIC FASTENINGS AND RUBBER JOINT (Clapham's Patent) FOR

DRY LUTE PURIFIERS.

THE "NEW CENTURY COVER" FOR PURIFIERS.

SELF-SEALING MOUTHPIECES for Inclined and Horizontal Retorts. MAINS, VALVES, &c.

LONDON AGENT:—THOMAS B. YOUNGER, C.E., Chesterfield House, 98, Great Tower Street.

WELLINGTON, NELSON, and MARKET STREET WORKS, KEIGHLEY.

Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON,—Tuesday, June 30, 1903.

DEPT. OF AGR.
JUL 15 1903

THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

[REGISTERED AS A NEWSPAPER.

VOL. LXXXII. No. 2094.] LONDON, JUNE 30, 1903. [55TH YEAR. PRICE 6d.

O'NEILL'S
OXIDE
GAS PURIFICATION
& CHEMICAL COMPANY, Ltd.
PALMERSTON HOUSE. LONDON, E.C.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 LONDON WALL.

SULPHATE OF AMMONIA PLANT.
AIR & GAS COMPRESSORS.
IRON & BRASS FOUNDERS.
ACID PUMPING ENGINES.
FERRO-CYANIDE PLANT
DAVIS-NEILL PROCESS
W. NEILL & SON
ST. HELENS JUNCTION.
Telegrams: 'NEILL, ST. HELENS.' Telephone No. 20.

THOMAS PIGGOTT & CO., LTD.,
BIRMINGHAM.
MAKERS OF
GASHOLDERS
AND
GAS PLANT.
LONDON OFFICE: 14 GREAT ST. THOMAS APOSTLE, E.C.

TORBAY - - - PAINT.
The TORBAY PAINT CO.,
26, 27, & 28, Billiter Street, London, E.C.
8, India Buildings Fenwick St., Liverpool.
Also at Brixham & Dartmouth, Devon.

TRADE MARK.
JOHN RUSSELL & CO., LTD.
Established at the Commencement of Gas Lighting.
MANUFACTURERS OF
TUBES & FITTINGS
For GAS, WATER, and STEAM,
STOCKS TAPS and DIES.
CHANDELIERS AND BRASS FITTINGS,
Pendants and Brackets for Prepayment Meter Supplies.
HEAD LONDON OFFICE:
145, QUEEN VICTORIA STREET, E.C.
WORKS:
WALSALL, WEDNESBURY, BIRMINGHAM.

CROSSLEY'S
"OTTO" GAS-ENGINE
Crossley's Engines and Pumps
are used in all the most recent and important Towns' Water and Sewage Installations.
LATER PATENTS. MANY NEW IMPROVEMENTS.
CROSSLEY BROS., Ltd.,
OPENSHAW, MANCHESTER.

PARKINSON AND W. & B. COWAN, LTD.
Parkinson Branch: LONDON AND BIRMINGHAM.
See Advertisements on p. 998 and p. IV
Cowan Branch: LONDON, MANCHESTER, EDINBURGH, & SYDNEY, N.S.W.
See Advertisement on Third Page of Wrapper.

JAMES McKELVIE & CO.,
CANNEL & GAS COAL EXPORTERS
HAYMARKET, EDINBURGH.
37 & 38, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL, NEWCASTLE-ON-TYNE
51 & 53, CASTLE STREET, LIVERPOOL.
PRICES AND ANALYSIS
of all the principal
CANNEL and GAS COALS
forwarded on Application
ESTABLISHED 1840.

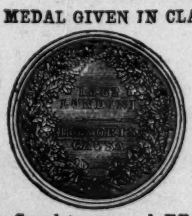
STEWARTS AND LLOYDS, LIMITED.
NILE STREET,
BIRMINGHAM.
GLASGOW, LONDON, LIVERPOOL, MANCHESTER, AND CARDIFF.
TUBES & FITTINGS.

GAS & WATER PIPES. JAMES & RONALD RITCHIE, LTD. (Late James Ritchie),
ACKLAM FOUNDRY, MIDDLESBROUGH.
TELEGRAMS: "RITCHIE MIDDLESBROUGH."

GEORGE GLOVER & CO.'S
IMPROVED DRY GAS-METERS,
STANDARD GASHOLDERS, AND TESTING APPARATUS.

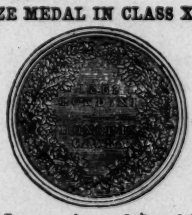
MEDALS AWARDED: INTERNATIONAL EXHIBITION, 1862.

ONLY MEDAL GIVEN IN CLASS X.



"For Ingenuity, Completeness, and Efficiency of Apparatus for Measuring Gas, and for Excellence of Material and Workmanship."

PRIZE MEDAL IN CLASS XXXI.



"For Superior Construction and Sound Workmanship."

FACSIMILE OF ADVERTISEMENT ISSUED BY GEORGE GLOVER & CO. 40 YEARS AGO.

THE SUPERIOR CONSTRUCTION AND SOUND WORKMANSHIP ARE MAINTAINED TO THIS DAY.

GEORGE GLOVER & Co., Ltd.
ROYAL AVENUE
CHELSEA LONDON S.W.

J. & J. BRADDOCK

(Branch of Meters Limited)

GLOBE METER WORKS,

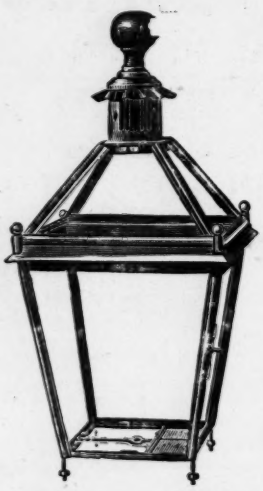
Telegrams:
"Braddock, Oldham." **OLDHAM.**

AND

45 & 47, WESTMINSTER BRIDGE ROAD,

Telegrams:
"Metrique, London." **LONDON, S.E.**

Improved Street Lamps.



GLAZED WITHOUT PUTTY.

STRONG AND DURABLE.

FOR HOME AND EXPORT.

SUPERIOR LAMP-TAPS.

PUTTYLESS STREET LAMPS SPECIALLY CONSTRUCTED FOR INCANDESCENT GAS LIGHTING.

EFFICIENT AND DURABLE

LAMPS AND TAPS KEPT IN STOCK.

ARROL-FOULIS

Patent Automatic Machinery

FOR

DRAWING AND CHARGING GAS-RETORTS.

Full Particulars may be obtained from the Sole Makers,

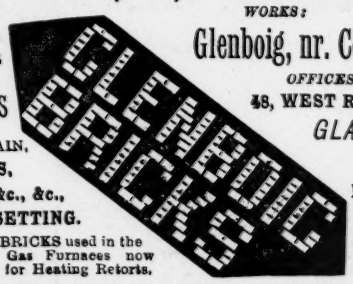
SIR WILLIAM ARROL & CO., Limited,

GLASGOW.

[See Illustrated Advertisement, June 2, p. 563.]

THE GLENBOIG UNION FIRE-CLAY Co. Ltd.

THE LARGEST MANUFACTURERS OF GAS-RETORTS IN GREAT BRITAIN, FIRE-BRICKS, BLOCKS, &c., &c., for RETORT-SETTING.



WORKS:
Glenboig, nr. Coatbridge.

OFFICES:
48, WEST REGENT ST., GLASGOW.

— 42 —
Prize Medals & DIPLOMAS OF HONOUR.
HIGHEST AWARD *wherever exhibited.*

The SPECIAL BRICKS used in the Construction of Gas Furnaces now being introduced for Heating Retorts.

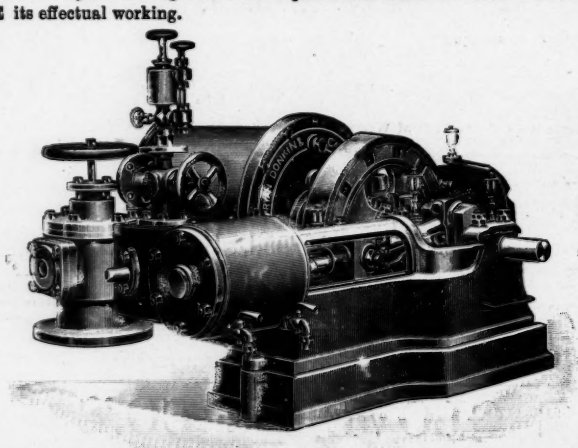
The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

GAS EXHAUSTING PLANT.

The Illustration below is from a Photograph of one of our **COMBINED EXHAUSTING PLANTS** designed by us for small Gas-Works, exhausting 2000 to 20,000 cubic feet of Gas per hour. We have already made about 200 such small Sets, all of which are **GIVING ENTIRE SATISFACTION.**

The **REGULATION** by means of the Hydraulic Regulator and Equilibrium Throttle Valve is now brought to **PRACTICAL PERFECTION**; and we can **GUARANTEE** its effectual working.

Very compact; the Engine and Exhauster being on one combination Base-Plate. All the adjustments and Self-lubricating arrangements are of the highest class; Workmanship and finish of the very best description.



We also make Exhausting Plants of capacities varying from 1000 to 750,000 cubic feet per hour, and have now made over 1000 Exhausters; our total **Manufacture** being over **60,000,000** cubic feet per hour, and our **annual** manufacture is now at the rate of **5,000,000** cubic feet per hour.

ORIGINAL MAKERS of the "Donkin" Internal Rack and Pinion Gas-Valve. Makers also of all other Types of Valves for Gas, Water, Liquor, Chemicals, and Steam. **GAS-VALVES** made from ¾ in. up to 48 in. diameter.

Also Makers of

STEAM-ENGINES of various Types and Sizes; PERRET'S BOILER FURNACES; AIR PROPELLER FANS; BLAST-FANS; CASTINGS IN IRON, GUN-METAL, OR ALUMINIUM.

BRYAN DONKIN & CLENCH, LIMITED,

Lincoln Works, CHESTERFIELD.

Telephone: 84 CHESTERFIELD. Telegraphic Address: "DONKIN CLENCH CHESTERFIELD."

London Office: Parliament Mansions, Victoria St., WESTMINSTER, S.W. Manchester Office: 10, Mawson Chambers, DEANSGATE.

C.30.c.

SAFETY OR BYE-PASS GOVERNORS

One of the most serious mishaps which can occur in the working of Gasholders is the accidental shutting-off of the Gas Supply to the district, through forgetfulness on the part of the Valveman to open the outlet of a Second Holder before he closes the First. Nor can this contingency be obviated by any system of working which depends upon the attendant's agency for carrying it out. The difficulties are increased when the Gasholders are manipulated in the manner best calculated to satisfy the Consumers as regards regularity in Illuminating Power—*i.e.*, by working into one Holder and out of another, reversing the operation when necessary, and thus giving the varying qualities of the "make" the opportunity to mix before they are sent into the district.

Our **SAFETY BYE-PASS GOVERNOR** has been designed as an absolute safeguard against any interruption in the town supply. It is fixed in any convenient position between the Outlet of the Station-Meter and the Inlet of the Governor, and is so arranged as to come into action the moment the Pressure on these falls below that given by the lightest Gasholder. When once set, the apparatus cannot be interfered with; and it may also, if desired, be completely enclosed.

We have supplied these **SAFETY GOVERNORS** to a number of Gas-Works, and shall be pleased to furnish a list of same to those who may favour us with inquiries.

PARKINSON AND W. & B. COWAN, LTD.

(COWAN BRANCH).

SMITH SQUARE WORKS, WESTMINSTER,	DALTON STREET WORKS, NEWTOWN,	BUCCLEUCH STREET WORKS,	COLONIAL METER WORKS, MACQUARIE PLACE,
LONDON, S.W.	**MANCHESTER.**	**EDINBURGH.**	**SYDNEY, N.S.W.**
TELEPHONE No. 250 WESTMINSTER.	TELEPHONE No. 1545.	TELEPHONE No. 753.	TELEPHONE No. 2529.
"DISC, LONDON."	"DISC, MANCHESTER."	"DISC, EDINBURGH."	"DISC, SYDNEY."

TELEGRAPHIC ADDRESSES:

Telegraphic Codes used, A1 and A.B.C. 4th Edition. Special Code furnished on application.

THE GAS-METER COMPANY, LIMITED.

WORKS: LONDON, OLDHAM, DUBLIN.

MANUFACTURERS OF

EVERY DESCRIPTION OF

GAS-METERS.

THE COMPANY MAKE TWO KINDS OF

PREPAYMENT METERS

viz.:

Valon's Stop Meter,

AND

The "Mutual" Slot Meter,

FOR PENNIES, SHILLINGS, OR ANY OTHER COIN.

ENGLISH or FOREIGN.

For Prices and Particulars, apply to

F. W. CHURCH, Secretary, 238, KINGSLAND ROAD, LONDON, N.E.

GAS RETORTS

HARRIS & PEARSON

STOURBRIDGE, ENGLAND.

GLAZED BRICKS, WHITE & IN COLOURS, PORCELAIN BATHS, FIRE-CLAY GOODS OF ALL KINDS, HARD BLUE PAVING BRICKS FOR RETORT HOUSES, BEST RETORT BOLTS, CAST-IRON RETORT MOUTHPIECES, FITTINGS, & LIDS, CAST IRON GAS & WATER PIPES & CONNECTIONS OF ALL SHAPES AND SIZES.

Manufacturers of

Fire Bricks, Lumps & Tiles

OF EVERY DESCRIPTION.

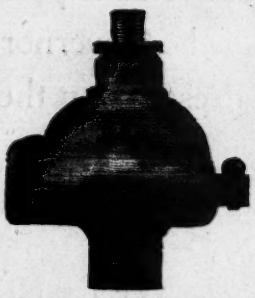
GOVERNORS FOR INCANDESCENTS

USED BY

The largest Gas Companies.

Metallic Volumetric Governor Disc or Cone Pattern.

It is not so easily seen, as with a Flat-Flame Burner, if an Incandescent Light is using more gas than it should. The only thing to do is to ensure it doesn't by adopting the best Governors.



Diaphragm Pressure Governor.

D. BRUCE PEEBLES & CO., EDINBURGH.

HANNA, DONALD, & WILSON,

(Established 1851),

GAS ENGINEERS & CONTRACTORS,

ABERCORN FOUNDRY AND ABBEY WORKS,

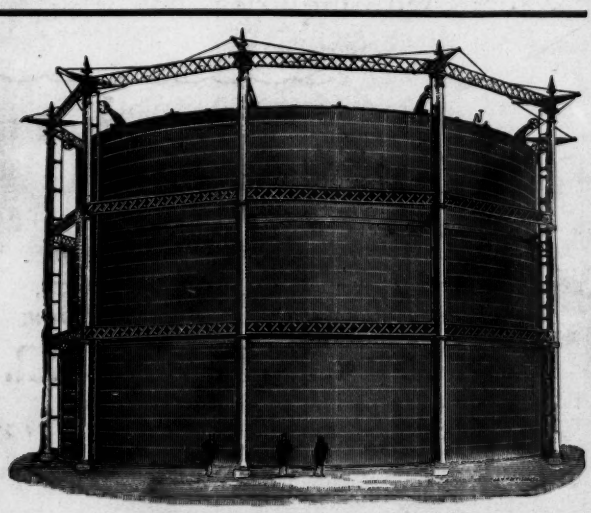
PAISLEY, N.B.,

MAKERS OF

Gasholders & Gas Plant

OF EVERY DESCRIPTION.

Telegraphic Address: "Donald, Paisley."



Printed for WALTER KING by King, Sell, & Olding, Ltd.; and published by him at 11, Bolt Court, Fleet Street, in the City of London.—Tuesday, June 30, 1908.